73 AMATEUR RADIO

April 199

Issue #3

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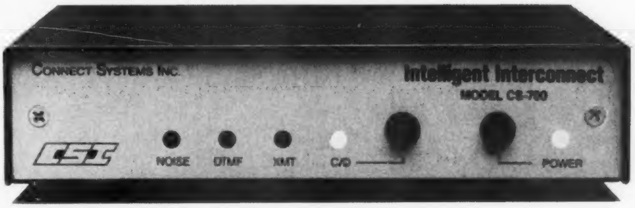

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LETTERS

From the Hamshack

Electric Blanket Mod Supply

After reading your column about the 60 hertz radiation, I was concerned. I also enjoy sleeping under an electric blanket. I didn't unplug my blanket, though. Instead, I built a DC power supply to power it.

I run the AC line through the existing thermostat, then through 17 ohms of 50 watt power resistors, then to a 600 PIV, 4 amp rectifier. The output of the rectifier is connected to a 200 volt, 7500 microfarad electrolytic capacitor and also to the blanket. The blanket now sees 115 volts of DC (at 135 watts) with 0.7 volts of ripple. I had to slightly modify the existing thermostat (shorten its heating wire) so it would behave exactly as before. This is due to the "wasted" power dissipated by the current/voltage limiting 17 ohm resistor.

It works flawlessly and I now sleep in "polarized" comfort! I am figurin' that this may even cause some of my dislocated brain cells to straighten out. A friend of mine suggested that perhaps if I were to "float" on a lake, I might even point north.

All joking aside . . . I did indeed build, and am using, the forementioned DC power supply for my electric blanket and at a cost of less than $15, using all new parts. I got the rectifier for a buck and a half and the 75 microfarad cap for $4.50.

I sure do hope you aren't gonna print anything negative about DC electromagnetic fields (I see a pun)! I also want to say that your editorials are at least half the reason I subscribe to *73 Magazine*. I enjoy them.

Gregory R. McIntire KE0UV
Belle Fourche S. Dakota

Gregory . . . Hey, you came up with a simple fix for your blanket. Great idea. I was wondering how the thermostats would adapt to DC operation.

I haven't seen much yet on the effects of DC fields on cell growth and communications . . . except one study which showed a remarkable cell effect when the cells were moved just a few degrees off the earth's magnetic field.

Just in case, I'm making do with blankets and a nice comforter . . . Wayne.

New Direction for Scouts

Regarding your comments [Mr. Green's] to the "Something for Beginners" letter in the Feb. '90 issue, page 56, I heard something on TV that might be worth checking into.

A national Boy Scout leader said the Scouts were changing policy with regard to their direction. It was becoming more socially oriented to help correct problems like functional illiteracy, the drug abuse situation, etc. I don't know if the Scouts would be receptive to including some ham radio indoctrination within their organization, but it seems possible. Likely there have been cooperative efforts between Scouts and hams before during emergency conditions.

This group has a national leadership that can implement programs nationwide. They may like to include some of the benefits of amateur radio within their new outlook even if they haven't done so before. And this might help compensate for the loss of ham support through school systems (which are not guided at a national level, but are guided regionally). The aim, of course, is to encourage the growth of the hobby by gaining younger blood.

Roy Ekberg W0LIQ
Brownsville TX

Newcomer to Amateur Radio

As a newcomer to amateur radio I find *73* very much suited to my interests and reading style. I am especially pleased with Wayne's monthly comments (tirades?). I got into ham radio this summer after returning from a three-year Peace Corps stint in Botswana. A long-term friend (N4PIV) prodded me into it. I was into 11m during the 70s but could never seem to learn the code. So this summer I cracked the whip and worked from Novice to Extra Class in just 2½ months. By the way, I am 26 years-old, just completing a Masters degree in plastics Engineering at U. Lowell, Massachusetts.

I was dismayed with what I heard on the HF bands. I'd had far more fun and meaningful communications on 11 meters. Another friend, N1GYH, worked with me to get his Tech Class. When he listened to HF one night, with a gleam in his eyes that he was finally on amateur radio, his face nearly cracked as he heard the nonsense contacts on 20m.

I want to comment on Wayne's editorial in the Jan. '90 issue, specifically with regards to Africa being hopeless. To imply that there are no countries in Africa that have decent education is a lark. It may not be as readily available as education here, but then have you checked Boston's SAT scores lately?

I taught junior/high school for three years at a school named Shashe. We had the best teachers from around the world there. When I compare the education I got with the education I was giving, there is no comparison. The European teachers were far more qualified.

A group of 11/12 grade students begged me to start a computer club for them. I got the funds to buy a computer, which usually drew 20+ children a day. These kids had the technical knowledge to handle communications. A few comprehended the physics of electronics better than I did. The headmaster made money available to buy an amateur radio to start a club. I'm kicking myself now for not making time to get another AA2 station on the air. I didn't know any better.

My comment is: When somebody goes on a DXpedition to one of these countries, seek out the high schools. There are Europeans and North Americans with technical backgrounds (Peace Corps volunteers, WVRST volunteers, etc.) at these high schools. Identify a person who can introduce amateur communications to the teachers, then go home and have the club donate some old equipment (or new) to get the school's club on the air. That way, at least with children on the air, the conversations will be far less boring and meaningless. At the most maybe a future presidency will be encouraged to continue his/her education in electronics and do something to encourage development and prosperity in the RICHEST continent. Wayne, keep kicking, you've got a good forum.

Bill Discipio N1GWR/AE
Hampstead NH 03841

I read with interest your comments concerning YLs in ham radio and the electronics field. I assure you that you are correct in your opinion of the treatment of females and minorities in the field of electronics.

I have been licensed since 1970 and hold an Advanced Class license. In addition I hold an FCC General Class Radiotelephone (former first class) license and am National Business and Educational Radio (NABER) certified. I have been employed in electronics for over 25 years and enjoyed every moment of it. I presently work for the Pennsylvania Emergency Management Agency (PEMA) as a Radio Telecommunications Specialist, and own my own company (Colorado Electronics Services). How am I treated? Like a know-nothing woman. My only satisfaction is in knowing that I am usually the one sent to do the job because I know my stuff.

Going back several months to your article on EMP, all I can say is good luck. I have been preaching the same thing for years and am tired of talking to stone walls. Even the Emergency Management people—at least here in Pennsylvania—have a deaf ear concerning high speed digital communications, not to mention EMP protection. It seems that in a time of emergency the politicians would rather talk to each other than pass important traffic; therefore, there is a great emphasis on voice circuits with telephone being the most wanted. Try as you might you can't get it through their heads that the phones are the first to go in an emergency. The thoughts of others in-the-know, concerning the possibility of EMP caused by terrorist activities, are met with a head-in-the-sand position. The consensus is that if the politicians don't think of it themselves, the idea is not worth pursuing.

Your comments in the January 1990 issue about the educational system are right on the target. You have started me thinking about getting into the video teaching aspect of education. I taught electronics in a vo-tech school until the lack of enrollments caused a layoff.

You mentioned the experiments by Estep in contacting the spirit world on VHF. I remember reading about and trying similar experiments years ago. I got some funny results but never followed through. Perhaps there is more there; maybe I will retry the experiments with more modern technology.

While on the subject of communications with other worlds, I will inform you that I am the Net Manager for the MUFON (Mutual UFO Network) amateur radio nets. We have several nets on the different amateur bands. Time and frequencies are: Saturday 8 AM Eastern 7237 kHz, Saturday 9 PM Eastern 3960 kHz, Sunday 3 PM Eastern 28470 kHz, and Thursday 8 PM Eastern 28460 kHz. All of these nets have a lot of check-in stations as well as SWLs. They are open nets and anyone is welcome to join in the conversations.

Keep on preaching the gospel, knowing that a few kindred souls—even females—are attuned to what you are saying.

Leslie Varnicle WA3QLW
Camp Hill PA

Thanks for your letter . . . and bravo on your MUFON work. Of course I've a theory . . . wrote it up several years ago in an editorial that UFOs may be more involved with time travel than just aliens . . . and that as such they can't permit too close contact without screwing up the future. They do seem to clean up after themselves very well.

Having read most of the books on the subject for some 40 years . . . and been a member of most UFO groups at one time or another . . . the data I've gathered seems consistent with time travel. That's one of the few consistencies.

I had a nice letter and a tape from Sarah Estep. Now I've got to make some time to see what I can do with a DAT recorder. That should increase the sensitivity enormously.

Right now I have to get outta here . . . off to Poland and Czechoslovakia today for ten days. I'll be talking with the ham groups there . . . and seeing what I can find in music to import and beef up their hard currency revenues . . . Wayne

Amateur Radio's Image

I just read a recent article of yours in the December issue of *73*. I have had the desire to get my amateur ticket for years and haven't been able to conquer Morse code. I think a no-code ticket would be great. I know many others who have the same problem and have shied away from getting their ticket due to code. I was shocked to see only 100 Canadians took advantage of the great opportunity the no-code ticket would offer. I would be the first in line.

I also think it is hard for an experienced ham to understand what someone on the outside thinks of amateur radio. It is not appealing to hear constant radio reports (like "I run a Kenwood and a dipole," etc.). That is the major reason many young people think ham radio is boring. I think your idea of making contacts more interesting is perfect. Your idea of nets for UFOs, etc., is great. The airwaves need to be interesting to attract younger people. Amateur radio is competing with more things now than ever before. Like the home computer and modems.

Amateur radio is also suffering from an image problem. Most outsiders seem to think you need to be a college professor to be involved in it. They could be educated by public service ads, or some high profile hams could mention it on national TV shows.

Deith Belongia
Racine WI 53504

14 MHz Controversy

Your November "Never Say Die" asked for comments regarding the 14.275/14.313 controversy. This is my comment.

All human conflicts have two sides. I know nothing of how this mess got started. I only know that it is now a disgrace. I have heard immaturity on both sides, idiots and KV4FZ. He obviously has a problem. I feel bad that so many otherwise intelligent hams allow themselves to lose their tempers and therefore their reason. The immature ones delight in causing people to lose their temper. If we could only learn that weirdos must have an "ear." If the good guys would ignore them, they would at least tire out. Every time they get an acknowledgment, they gain strength.

As I see it, we have three separate problems which are interrelated: intentional jammers, objections to nets "owning" frequencies, and third-party traffic other than health and welfare or emergency.

I believe an attempt should be made by the amateur community to stop the present trouble. Perhaps you, the ARRL, or maybe the FCC could take a poll of the amateur community and find out how the majority feel. Then the FCC or Congress could be pressured to enforce the wishes of the majority.

I am in favor of assigning a specific frequency to a net with definite hours. This would give a net authority to use a frequency. The publishing of this information would reduce most of the unintentional QRM.

I am also in favor of allowing third party traffic, and see nothing wrong with the operation on 14.300 as it is practiced at this time. Few amateurs would purchase equipment and learn to use it if it could be used only rarely.

I am not yet a subscriber to *73*. I have only recently noticed your publication, and purchased Nov. and Dec. off the newsstand. It looks good so far, congratulations. I think I could learn to like you.

W.S. Latham AB4PG
DeLand FL

"Safe" Communication?

I enjoyed the challenges (definitely plural!) of reading your January column, but I wonder whether you haven't missed a possible reason for the general level of apathy in the ham ranks. It seems to me that many hams may be drawn to the hobby because, paradoxically, they are not good communicators. Rather, they may be drawn by the patina of the "semi-technical" skills and procedures which allow them to pretend to communicate. Witness contesting! Witness packet bulletin boards! Witness CW!

A similar phenomenon seems to be a normal phase of American adolescent development, only the patina of choice is the telephone. Many teenagers seem to use the telephone as a learning tool on which they can practice their communications skills without the dangers of face-to-face communications. After they master the basic skills and jargon, they can move on to develop more intimate personal relationships face-to-face.

I wonder whether many hams might actually be afraid (too strong a word?—maybe just uncomfortable) of close personal contacts, so they pretend. Ham radio offers a multitude of substitutes for real personal communications, and it offers an almost perfect stage. These substitutes can be challenging and even lots of fun, but when the medium substitutes for the content, there is no communication!

It's no wonder that ham club meetings are, for the most part, uninspiring. What else could you reasonably expect from an arbitrary collection of mostly white men, most of whom are not really comfortable with personal contacts, who have adopted Roberts' Rules (another stifling way to pretend) to govern themselves? There also seems to me a sacred dictum (ARRL, *ex cathedra?*) that only certain topics are safe for ham club meetings.

Most of the hams I meet, on-the-air or face-to-face, sound like they could be interesting people underneath their ham-veneers, but I am frequently rebuffed when I try to move a QSO into something which might be interesting (but which might draw them into expressing a personal opinion)—"Well, I'm destinated [sic—yecch!]. I'll say 73s now and wait for your final." I don't know why I bother trying sometimes. I certainly have alternate uses for the modest time and money I spend on ham radio—like the local bookstore. I, like you, am an avid reader.

I wonder why you keep trying—I don't think it's for the money. You seem to enjoy the status of "prophet" (rabble-rouser), and you seem to have a genuine concern for the rest of us hams. I usually enjoy reading your columns and exploring my own reactions (both positive and negative). Most importantly, I learn something every time—I could have gone my whole TV-less life without ever hearing about the Lambada.

I am still thinking about your "expose" of the American public education system. I am a product of it in the '60s when we were trying to save the world from communism through advanced math, etc. Since our own kids have grown and gone, I've been out of touch with the schools. I have been vaguely aware that something's wrong, but I don't know enough about what's happening (not happening?). I also don't have a clear picture of what I expect, or what we need, so it will take me a while to chart out how to get there, and more importantly, how I might help. Thank you for challenging me to start.

Tom Russel NT4H
Portsmouth VA

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Wayne Green Enterprises is a division of International Data Group.
Reprints: The first copy of an article $3.00 (each additional copy—$1.50). Write to *73 Amateur Radio Magazine*, WGE Center, Forest Road, Hancock, NH 03449.

FB

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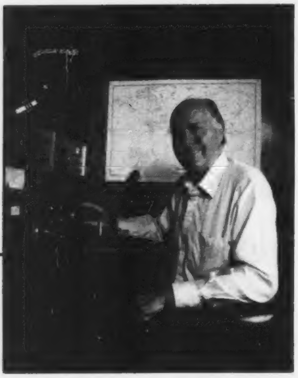
Wayne Green W2NSD/1



73's Revolving Door

Amidst a flurry of misspelled names and calls, one of the less necessary ham newsletters took a swing at me (so what's new?) citing the ever-changing *73* staff as proof that Wayne is awful to work for. Yeah, I'm a terror. As usual, the editor never bothered to check his information for reliability.

Yes, you bet I keep the door revolving at Wayne Green Enterprises. I don't fire many people... far too few, really. But that door is going to keep turning as long as I'm alive. I don't want staffers to stay here for a lifetime. I try to find people who are young and interested in learning everything they can about publishing. Then I do all I can to make their experience at WGE as educational as possible. People who refuse to take advantage of the learning experience and insist on doing the same damned thing for years I encourage to depart to make room for people who will take advantage of the career development potentials I have here.

WGE is not just a publishing company... it's also a publishing institute and is even registered as such in New Hampshire. It's also an entrepreneurial small business incubator. That's the way I've run my publishing businesses for the last 15 years.

In the last two years I've gotten rid of every "manager" in the place. Oh, I've tried to make management teams work, but I found they stifled progress. It shocked everyone when I cleaned out the general, business, ad sales and financial managers all at one time and personally took over their jobs a year and a half ago. Actually, I didn't have to do much additional work, I just set the staffers free who'd been held back by their "management." Our costs went way down and our revenues went way up.

I recently got fed up with the constipation in producing *73* so I eliminated all job titles. I redid the masthead with everyone just listed as "staff." Further, instead of articles sometimes having to wait weeks for an editor-in-chief to get to them, now they're tackled as they arrive by any of the staff who's handy.

My system has worked out well in the past. *73* editors have come aboard with little or no previous training and have gone on to some very nice jobs. Heck, one of them is running one of the largest PR agencies in California. And one of my circulation people is doing great with *Inc.* magazine. Another of my editors went on to edit *Infoworld.* My alumni are all through the publishing industry.

How do I run a business without managers? I do it with team leaders. Everyone works. None of this, "that isn't my job" nonsense.

I do most of my own work at my farm, which is a few minutes from the WGE building. I'm set up there with my laptop computer, FAX, a 2m repeater and a little ham rig. The big rig, beam, packet, SSTV, OSCAR setup and all is at the WGE building, where it's used more by the 73 staff than by me.

I pop into WGE twice a day for meetings and to see what problems need solving. I help with cover design ideas, okay artwork and see how things are going. At the farm I answer my mail, keep up with radio, computer, electronic and audio technology, write editorials for all my publications, write endless subscription letters, review new CDs, produce my own CDs (Greener Pastures Records... with a state-of-the-art recording studio at the farm).

Between giving talks at hamfests and ham clubs and attending music and electronic industry shows, I'm kept busy and have far too little time for skiing, skin diving and hamming. This year I'm scheduled to give ham talks in Dayton, Minneapolis, Munich, Vienna, Atlanta and Boxborough. The music and electronic shows are in Las Vegas, Los Angeles, Nashville, Chicago, Cannes. And that's just what I know about so far.

I'd like to take some time to see what I can do to help the artists and performers in the Eastern European countries get their music distributed in America in order to generate some badly needed hard currency for them. If these countries are going to change from communism to democracy, they're going to need a way for the artists who were state supported to earn money. I think I can help.

Then there's my work in education, which is coming along very well. I have to budget some time to get to colleges to lecture... and to work with colleges to help them cope with the '90s.

Locally I'm working with the Chamber of Commerce to make some badly needed local changes ... and am the treasurer of the local hospital board.

Getting back to *73*... I have several goals for *73.* One is to make it more fun to read, and more educational. I'm particularly anxious to get amateur radio growing again by attracting youngsters to the hobby by the hundreds of thousands. I have some plans for doing this, but they're going to take some time and work.

I formed the National Industry Advisory Committee to help bring the ham industry and the FCC Commissioners together and perhaps even stem the tide of lost bands. I don't think the ARRL approach of suing the FCC and fighting them at every turn is a productive approach.

The present *73* staff is top notch. In addition, we're also tapping the technical expertise of Larry Antonuk WB9RRT. Mike Nugent WB8GLQ, the editor of *Portable 100* magazine, is also helping. And Jim Morrissett K6MH is leading the team. Jim first worked for me as the assistant editor of *CQ* magazine back in 1955.

So there you have it. I tend to look for youngsters with promise to work for *73.* I encourage them to learn everything they can and then move on to companies where they'll get better pay. *73,* which has lost money for years, probably will never pay big salaries, but it's a corking place to learn publishing... and to have a ball testing the newest of ham gear, going on DXpeditions and to hamfests.

I mentioned our business incubator. Right now we have 23 new businesses we're starting. These offer even more opportunities for learning new skills and getting more upscale salaries.

One that's doing particularly well is Music/NH, a new mail order CD company. Then there's Buys, Inc., which has been selling 10,000 or so CDs a month for the last year. And Greener Pastures Records, which just put out its first CD release... Scott Kirby playing Scott Joplin. We've got a bunch more in the works. There's always something exciting going on.

Our *CD Guide* electronic edition on CD-ROM has taken off in sales. Record stores and libraries are buying it. Philips has bought 30,000 copies for their new Headstart computer system.

We've got Indie Info Inc., a credit checking source for independent record companies. There's *Adventures In Music,* a publication for radio stations telling 'em what's new in CDs. And *Music Retailing*, which goes to over 10,000 record stores to let them know what's new and what's hot in indie music.

US News had a chart showing the average employee turnaround in America. We're doing considerably better than average. They showed 23% of the employees working less than one year.

So, yes, we do have a revolving door at WGE and *73* magazine. We do tend to lose people who aren't able to work as a team or who aren't really interested in developing their careers. Most of the people who move on to better jobs keep in touch and remain good friends.

I do try to make things as friendly as possible. One of our ad sales gals had a baby recently. She wanted to be able to stay at home to take care of her new baby, but

Continued on page 75

KENWOOD

Affordable DX-ing!

TS-140S/680S

HF transceiver with general coverage receiver.

Compact, easy-to-use, full of operating enhancements, and feature packed. These words describe the new TS-140S HF transceiver. Setting the pace once again, Kenwood introduces new innovations in the world of "look-alike" transceivers!

- **Covers all HF Amateur bands with 100 W output.** General coverage receiver tunes from 50 kHz to 35 MHz. *(Receiver specifications guaranteed from 500 kHz to 30 MHz.)* Modifiable for HF MARS operation. *(Permit required)*
- **All modes built-in.** LSB, USB, CW, FM and AM.
- **Superior receiver dynamic range** Kenwood DynaMix™ high sensitivity direct mixing system ensures true 102 dB receiver dynamic range.
- **New Feature! Programmable band marker.** Useful for staying within the limits of your ham license. For contesters, program in the suggested frequencies to prevent QRM to non-participants.
- **Famous Kenwood interference reducing circuits.** IF shift, dual noise blankers, RIT, RF attenuator, selectable AGC, and FM squelch.
- **M.CH/VFO CH sub-dial.** 10 kHz step tuning for quick QSY at VFO mode, and UP/DOWN memory channel for easy operation.
- **31 memory channels.** Store frequency, mode and CW wide/narrow selection. Split frequencies may be stored in 10 channels for repeater operation.
- Selectable full (QSK) or semi break-in CW.
- RF power output control.
- AMTOR/PACKET compatible!
- Built-in VOX circuit.
- MC-43S UP/DOWN mic. included.

Optional Accessories

• **AT-130** compact antenna tuner • **AT-250** automatic antenna tuner • **HS-5/HS-6** headphones • **IF-232C/IF-10C** computer interface • **MA-5/VP-1** HF mobile antenna (5 bands) • **MB-430** mobile bracket • **MC-43S** extra UP/DOWN hand mic • **MC-55** (8-pin) goose neck mobile mic • **MC-60A/MC-80/MC-85** disk mics • **PG-2S** extra DC cable • **PS-430** power supply • **SP-41/SP-50B** mobile speakers • **SP-430** external speaker • **SW-2100** SWR/power meter • **TL-922A** 2 kW PEP linear amplifier (not for CW QSK) • **TU-8** CTCSS tone unit • **YG-455C-1** 500 Hz deluxe CW filter **YK-455C-1** New 500 Hz CW filter

KENWOOD U.S.A. CORPORATION
COMMUNICATIONS & TEST EQUIPMENT GROUP
P.O. BOX 22745, 2201 E. Dominguez Street
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PWR MIN MAX
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RF GAIN MIN MAX
NB LEVEL MIN MAX
1MHz
RIT
NB1
NB2

TS-680S

All-mode multi-bander

- 6m (50-54 MHz) 10 W output plus all HF Amateur bands (100 W output).
- Extended 6m receiver frequency range 45 MHz to 60 MHz. Specs. guaranteed from 50 to 54 MHz.
- Same functions of the TS-140S except optional VOX (VOX-4 required for VOX operation).
- Preamplifier for 6 and 10 meter band.

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications, features, and prices are subject to change without notice or obligation.

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Stacked in your favor!

TM-231A/ 331A/431A/531A

FM Mobile Transceiver

Looking for a compact transceiver for your mobile VHF and UHF operations? KENWOOD has a compact rig for each of the most popular VHF/ UHF bands.

- **20 multi-function memory channels.**
- **High performance — high power! 50W (TM-231A), 35W (TM-431A) with a 3 position power switch.**
- **Optional full-function remote controller (RC-20).** A full-function remote controller can be mounted in any convenient location. Using the IF-20 interface the RC-20 may be connected to four mobile transceivers. (TM-231A/ 431A/531A or the TM-701A).
- **Multi-function microphone supplied.** Various controls are provided on the mic. for increased utility.
- **Auto repeater offset on 144 and 220 MHz.**
- **Built-in digital VFO allows selection of the frequency step.** (5, 10, 15, 20, 12.5, 25kHz; TM-531A: 10, 20, 12.5, 25kHz.)
- **Selectable CTCSS tone built-in.**
- **Tone alert system — for true "quiet monitoring"!** When enabled this function will activate a tone when squelch opens.
- **DRS (Digital recording system).** The optional DRU-1 can store received and transmitted messages for up to 32 seconds, allowing the operator to check or return any call using the tone alert system.
- **Automatic lock tuning function (TM-531A).**
- **Repeater reverse switch.**

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POWER
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20
CALL
SHIFT
TONE
REV
DRS
KENWOOD TM-331A
224.980
KENWOOD TM-431A
AL
CTCSS
448.525
KENWOOD TM-531A
1240.000
KENWOOD

TM-231A
136–174 MHz receive,
TX on Amateur bands only.
Modifiable for MARS/CAP.
Permit required.

Optional Accessories:
• **RC-20** Full-function remote controller • **RC-10** Handset • **IF-20** Interface unit handset • **DRU-1** Digital recording unit • **MC-44** Multi-function hand mic. • **MC-44DM** Multi-function hand mic. with auto-patch • **MC-48B** 16-key DTMF hand mic. • **MC-55** 8-pin mobile mic. • **MC-60A/80/85** Desktop mics. • **MA-700** Dual band (2m/ 70cm) mobile antenna (mount not supplied) • **SP-41** Compact mobile speaker • **SP-50B** Mobile speaker • **PS-430** Power supply • **MB-201** Mobile mount • **PG-2N** Power cable • **PG-3B** DC line noise filter • **PG-4H** Interface connecting cable • **PG-4J** Extension cable kit • **TSU-6** CTCSS unit

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Complete service manuals are available for all Kenwood transceivers and most accessories.
Specifications, features and prices are subject to change without notice or obligation.

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

ARRL President Urged to Resign

Five prominent radio amateurs have asked ARRL President Larry E. Price W4RA to decline his nomination for another 2-year term. The request, sent by mail, was signed by Stuart Cowan W2LX, William Orr W6SAI, Pete Hoover W6ZH, Joseph Schroeder W9JUV, and A. Prose Walker W4BW. The authors stated that they believe the ARRL under Dr. Price's direction has failed to "...adequately meet either the domestic or international challenges facing amateur radio today, and that a change in ARRL leadership is absolutely necessary if we are to survive these challenges in the coming decades." (From *Westlink.*)

Grant for HF Packet Research

A team of amateurs headed by Stephen Hall WM6P, of Simi Valley, California, received a $1,000 grant this year from the ARRL. The team will investigate the benefits of diversity reception for HF packet radio, and design practical diversity antenna systems, modems, and receivers. For a discussion of diversity reception and its potential benefits in amateur radio, see the chapter on digital communications in *The 1990 ARRL Handbook.*

Co-investigators in the team are Andy Demartini KC2FF of Clearwater, Florida; Wally Linstruth WA6JPR and Bill Lake WB6RIJ of Santa Barbara, California; Herb Duncan WE7L and Peter LaCount W8UXD of Sierra Vista, Arizona. (From *GRAARC.*)

New DXCC Countries

The ARRL Awards Committee has unanimously agreed to add Banaba Island T33 and Conway Reef 3D2 to the DXCC Countries List. No no activity is believed to have taken place from Conway (3D2), a territory of the Republic of Fiji, prior to the 3D2CR operation of April 1989, so contacts are creditable with the start of this operation.

Banaba (T33), part of the Republic of Kiribati, was formerly known as Ocean Island. A few operations with callsign prefix VR1 from Banaba occurred before the T33JS/T33RA activity of May 1989. They will also be creditable.

QSL cards may be submitted for Conway and Banaba on or after March 1, 1990. For more information, contact Don Search W3AZD at ARRL HQ. (From *The DX Bulletin* and *Watts New.*)

Amateur Radio Astronomy

If you'd like to get into amateur radio astronomy, an international organization exists to help you. For information on how to get started, write S.A.R.A. Membership Services, PO Box 4208, Tampa FL 33677, or call Jim Pitts, the Librarian and Educational Chairman of S.A.R.A, at (502) 459-5804.

While it's unlikely that amateur radio astronomers can compete with the huge antennas used by professionals, amateurs can pursue various rewarding projects: indirect monitoring of solar flares, meteor monitoring, imaging of strong radio sources, pulsar detection, and Jupiter studies. Most of these projects require simple, though sensitive, equipment and relatively small antennas. You do not have to be an electronic wizard to obtain thrilling results. Radio telescopes consist of the same type of equipment in amateur radio stations, only they are arranged differently. (From *Watts New.*)

Signals from Space

Easy-to-monitor signals from space include US and Soviet navigational satellites between 149.910 and 150.030 MHz. You can hear them on a 2 meter HT or portable scanner with a rubber duck. *MIR,* the Soviet manned space station, is loud and clear on 143.625 MHz FM. The cosmonauts on *MIR* ran a 2 meter operation on or near 145.550 using the calls U1MIR, U2MIR, and U3MIR.

You can hear the new Microsats beaconing on 435.07, 435.12, 437.025, 145.825, 437.075, 437.150, and 437.125. (From the *Nashua Area Radio Club Bulletin.*)

Automatic HF Data Transmission

The League has concluded that desirability of automatic operation on the HF bands has been firmly established. Last December 12, ARRL Counsel Chris Imlay N3AKD filed a petition with the FCC, seeking the adoption of rules to permit limited HF RTTY and data communication under automatic control. The petition seeks designation of the following band segments as being available, though not exclusively, for automatic control of RTTY and data transmissions: 3605–3615 kHz, 7035–7045 kHz, 10140–10150 kHz, 14090–14100, 18100–18110 kHz, 21090–21100 kHz, 24920–24930 kHz, and 28100–28120 kHz.

The Leagues's proposal seeks inclusion of automatically controlled AMTOR and Baudot as well. From the petition, "...AMTOR is more robust than packet radio and is used to bridge difficult radio paths...manually controlled Baudot RTTY 'mailboxes' (or MSOs) have been active in the Amateur Radio Service since the early 1980s.... Manual control...is an unnecessary burden on the mailbox system operators....the benefits of automatic operation are shared by amateur operators worldwide and are instantly available to provide public service during disasters." (From *The ARRL Letter.*)

Land of Radio Enthusiasts

Japan lists over 5 million radio stations. These include 950,000 amateur radio stations, 2,390,000 CB-type radio stations, 1,540,000 portable/mobile radio stations, and 120,000 "miscellaneous" radio stations. The US lists a paper figure of approximately 509,000 licensed amateurs. (From the *B-N-T Bulletin.*)

Amateur Radio at Malta

When Gorbachev and President Bush met at Malta, amateur radio was there, too. Network news crews always have a few hams among them, and when not at work, they operate their improvised ham setups.

Steve Mendelsohn WA2DHF, ARRL's Hudson Division Director, took his Kenwood TS-130S along and strung a simple dipole off the hotel balcony. In 20 minutes he had worked all continents using the assigned Malta call of 9H3LO. Ed Tobias as 9H3LN and Tony Brunton as 9H3LM also joined in the fun.

The Soviet Union permitted special event station US1UGB to operate from Moscow, commemorating this event. If you made contact with that station, you can QSL direct to UK3A. No need to go through Box 88, Moscow, for approval! (From the *B-N-T Bulletin.*)

Stolen Transceiver

The Brevard County Sheriff's Department in Florida recovered a Yaesu FT-208 early last February. It has several identifying markings. If you think this radio may be yours, contact the Brevard County Sheriff's Office at (407) 631-6000, and identify the markings. The case number is 90-014450. (Submitted by Bill Newkirk WB9IVR via CompuServe.)

FAR Scholarships

The Foundation for Amateur Radio, Inc., plans to award 33 scholarships during 1990–91 to assist licensed radio amateurs. If you're a full-time student, or have been accepted for enrollment at an accredited university, college, or technical school, request an application now, by letter or QSL card. Request must be postmarked prior to May 31, 1990. FAR Scholarships, 6903 Rhode Island Avenue, College Park MD 20740.

TNX to QRX Contributors

Thanks to *GRAARC, The DX Bulletin, Watts New, Nashua Area Radio Club Bulletin, The ARRL Letter, the B-N-T Bulletin, Westlink,* and Bill Newkirk WB9IVR.

Number 4 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the June issue, we should receive it by March 31. Provide a clear, concise summary of the essential details about your Special Event.

APRIL 1, 1990

GROSS POINTE WOODS MI The South Eastern Michigan ARA will hold its 32nd annual ARRL Sanctioned Hamfest/Swap-n-Shop at the Grosse Pointe North High School from 8 AM–2 PM. Exams, Forums, and an on-the-air packet station. Advance tables $8, $10 at the door. Advance tickets $2, $4 at the door. Talk-in on the W8FWC Repeater: 146.74/.14. For more information, SASE to *SEMARA SWAP, PO Box 646, St. Clair Shores MI 48080-0646 or phone 313–323–4099 anytime.*

APRIL 7, 1990

BENTON HARBOR MI The Blossomland ARA is sponsoring their Hamfest at the Fair Plain Jr. High School from 8 AM–12 PM. Set-up at 6 AM. VE Exams. Free parking. Call *Lee Lull WR8R, 616–926–1747* to register before March 31. Tables (provided), $5. Admission $3. Contact *Paul Reissman WD8MWT, c/o B.A.R.A., PO Box 175, St. Joseph MI 49085. 616–429–6230.*

LONGMONT CO The Longmont ARC Hamfest/Computer Swap will be held at the Boulder County Fairgrounds from 8 AM–3 PM. Admission is $3, tables are $7. A CAD system will be used to help all exhibitors make advance reservations for specific table locations. Contact *Bob Dornan WA2EKU, 1106 Fordham St., Longmont CO 80501. 303–651–3613.*

ROCHESTER MN The Rochester ARC will sponsor the 13th annual Rochester Area Hamfest & Computer/Electronic Show at the John Adams Junior High School. Set-up Friday the 6th from 4:30 PM–7:30 PM. Doors open at 8:30 AM Saturday. Indoor Flea Market for radio, computer and electronic items. Free parking. Talk-in on 146.22/.82. W0MXW. Contact *R.A.R.C., c/o N0HZN, 2824 NW 24th St., Rochester MN 55901.*

COLUMBUS IN The Columbus ARC Hamfest will be held at the Bartholomew County 4-H Fairgrounds between 8 AM and 2 PM. Talk-in on 146.79–600 Hz. Contact *Marion Winterberg WD9HTN, 11941 W. Sawmill Rd., Columbus IN 47201. 812–342–4670.*

APRIL 8, 1990

FRAMINGHAM MA The Framingham ARA is sponsoring a Flea Market at the Framingham Civic League Building to support the Dr. Carlton Crosby Memorial Scholarship Fund. Early bird admission $5 at 9 AM, general admission $2 at 10 AM. Six foot tables $12 in advance (includes one admission). Set-up 8 AM–10 AM. Preregistration for exams is strongly suggested. Exam info, *Dick WA1KUG, 508–877–0568.* Table info, *Jon K1VVC, 508–877–7166.*

APRIL 9, 1990

BOULDER CO The Boulder VE Team will hold VE Exams at the American Legion at 7 PM. Call *Barbara McClune N0BWS, 303–530–1872.* Pre-registration preferred, walk-ins welcome.

APRIL 14, 1990

CLARKSVILLE TN A Hamfest will be sponsored by the Clarksville Amateur Transmitting Society, Inc. at the Clarksville National Guard Armory from 8 AM–3 PM. Flea Market, Auction, Free parking. VE Exams, contact *Larry Burns WD4DBJ, Rt. 1 Box 162A, Indian Mound TN 37079* or telephone *615–232–6141.* Admission $2. For tables contact *Lucky Holeman KF4L, 411 Jordan Rd., Clarksville TN 37042. 615–647–7804.*

BOWLING GREEN KY The Kentucky Colonel's ARC is sponsoring HAMBOREE '90 at the National Guard Armory. $2 advance, $3 at the door. Children under 12 free with paid adult. Tables $10. Talk-in on 146.25/.85 and 147.93/.33. Info/Reservations: *KCARC, PO Box 9781, Bowling Green KY 42102-9781. 502–843–2395.*

CLINTON TN The Oak Ridge Hamfest '90 is being sponsored by the Oak Ridge ARC at the National Guard Armory from 8 AM–5 PM. Admission is $3 per person. Contact *Gene Muncy KB4UMM, RT 8 Box 539, Powell TN 37849. 615–945–5349.* FCC license exams will be at 10 AM. You must pre-register before 4 April. Send a check for $4.95 made payable to WCARS/VEC, a copy of your license and a completed 610 form to *Ray Adams N4BAQ, 4325 Felty Drive, Knoxville TN 37918.* Bring original license and two IDs to exam.

APRIL 14–15, 1990

ABILENE TX 1st ARRL West Texas Section Convention & KCARC Swapfest will be held at the Civic Center by the Key City ARC on Saturday from 8 AM–5 PM, and on Sunday from 9 AM–4 PM. Dealer/Seller set-up 6 PM–10 PM Friday, 6–8 AM Saturday. Tables $2 each. VE Exams. Walk-ins OK. Pre-Register for $5, $6 at the door. Please send pre-registration by 11 April to *KCARC, PO Box 2722, Abilene TX 79604.* For information contact *Bill Jones N5DOX, 915–698–4606.*

APRIL 15, 1990

CAMBRIDGE MA A TAILGATE electronics, computer/amateur radio FLEA MARKET, will be sponsored by the MIT Electronics Research Society and the MIT Radio Society at Albany and Main St. from 9 AM–4 PM. Admission $1.50. Free off-street parking. Sellers $5 per space in advance, $6 per space at the gate, (includes 1 admission). Set-up 7 AM. Talk-in on 146.52 and 449.725/444.725–pl 2A–W1XM/R. Call *617–253–3776.* Mail advance reservations before 5 April to *Richard Brezina, 3 Ames Street, Cambridge MA 02139.*

APRIL 21, 1990

LAWTON OK The Lawton-Fort Sill ARC will hold their 43rd annual Hamfest at the County Fairgrounds from 8 AM–5 PM. No pre-registration necessary except for table space. Talk-in on 147.39/.99. Contact *Claude R. Matchette, 3411 NW Atlanta Ave., Lawton OK 73505. 405–357–5870.*

APRIL 22, 1990

CLEVELAND OH The North Coast ARC Spring Swapfest will be held at the North Olmsted High School from 9 AM–2 PM. Advance tables $5 each. Admission $3. Talk-in on 145.29 and 224.76 repeaters. Additional info on NCARC PBBS (C NO8M on 145.09) D NCARC/SWAPFEST.INF, or phone *Chuck K8RSH at 216–777–1595.*

SULLIVAN IL The Moultrie AR Klub will have their Hamfest 5 miles east of Sullivan on the Caldwell Road. Exams from 9 AM–12 PM. Walk-ins accepted. Tables $7.50 each. Limited space, first come, first serve. Tickets $4 advance or at gate. Contact *Ralph Zancha, 502 E. State St., Lovington IL 61937. 217–873–5287 evenings.*

SOUTHINGTON CT The 7th annual Southington ARA Fleamarket will be held in the Southington High School Cafeteria. Admission is a $3 donation at the door. Free for children under 12. 6 foot table space available for $10 in advance and $14 at the door. For table info send SASE to *S.A.R.A. 1990 Fleamarket, PO Box 873, Southington CT 06489* Pre-register for exams. Send info to *VE Exams, 1990 Fleamarket, PO Box 873, Southington CT 06489.* Talk-in: 146.28/.88, 222.20/224.80, 449.25/444.25. Contact *Chet KA1ILH, 203–628–9346 5 PM–9 PM.*

WELLESLEY MA The Wellesley ARS will sponsor a special event at the Wellesley Senior High School parking lot from 9 AM–2 PM. Handicap accessible. Admission $2. Talk-in: 147.03/.63 (Wellesley Repeater). Contact *Gerry Driscoll NV1T, 617–444–2686.*

APRIL 27, 1990

DAYTON OH The Dayton-Cincinnati Chapter of the Quarter Century Wireless Association announces the 1990 annual QCWA Banquet, to be held the first evening of the Dayton Hamvention, beginning at 7:30 PM EST at Neil's Heritage House. Membership not required to attend. Contact *Bob Dingle KA4LAU, 657 Dell Ridge Drive, Dayton OH 45429. 513–299–7114.*

Special Event Stations

APRIL 2–4, 1990

FORT WORTH TX Southwestern Baptist Theological Seminary will operate NG5A at 1400–0000Z each day, to celebrate the 75th anniversary of its School of Religious Education. Frequencies: 28.375, 21.375, and 14.375, plus/minus QRM. For QSL card, send your QSL and SASE to *Southwestern Baptist Theological Seminary, (SWBTS), PO Box 22068, Fort Worth TX 76122.*

APRIL 7–8, 1990

LAUDERDALE COUNTY TN The Tipton County ARES Club will host Station KC7YL from historic Fort Pillow State Park from 0200Z 7 April thru 2200Z 8 April. Frequencies: 28.375, 21.375, 14.275 and 14.275. For certificate, send QSL and large SASE to *Herb Harrington WB4DPL, PO Box 402, Covington TN 38019.* Phone WB4DPL at *901–476–4445, or David Siglin KC4LTC at 901–837–8362.*

APRIL 8, 1990

DELAWARE Never ones to learn from past mistakes, the members of the Warminster ARC will conduct their second annual DXpedition to the rare state of Delaware, operating WA3DFU/3. Frequencies: 7.275 MHz, 14.275 and 28.375 MHz. CW contacts will be made on request. QSL with SASE to *Warminster A.R.C., Box 113, Warminster PA 18974.*

APRIL 11, 1990

MOBILE AL The Mobile ARC will operate K4RQQ from the radio room of the submarine USS Drum from 1400–2400 UTC to commemorate the 75th Anniversary of US Naval Submarine Service. Frequencies: 3.965, 14.260, 21.360, 28.360 and local 2 meter repeaters. For certificate send QSL and 9 x 12 SASE to *Murray Flanders K4RQQ, 9075 Howells Ferry Rd., Semmes AL 36575.*

APRIL 22–27, 1990

ARLINGTON HEIGHTS IL The USEPA5 ARC will operate KA9NLX on 160–10 meters, from 1400Z–2400Z daily to commemorate the 20th anniversary of Earth Day. A certificate will be sent upon receipt of a QSL card. Send to *John Paskevicz KA9NLX, 1423 N. Ridge Ave., Arlington Heights IL 60004.*

APRIL 28, 1990

GALENA IL The Great River ARC of Dubuque IA will operate Station WK9O from 10 AM–4 PM at the 36th Annual U.S. Boy Scout Pilgrimage, on the lower General band and Novice 10 meter band, SSB. No SAE, QSL required for certificate. Contact *Loran Schonhoff, 5710 North Menominee Rd., East Dubuque IL 61025.*

MANTEO NC The Raleigh ARS and the Outer Banks Repeater Association will celebrate the 200th Anniversary of the founding of the United States Coast Guard by operating Station W4DW in the General portion of all bands and the Novice portion of 10 meters, from 1200Z 28 April–1500Z 29 April. For QSL card send a #10 SASE to *RARS, PO Box 17124, Raleigh NC 27619.*

GARDEN GROVE CA The Clairmont Repeater Association will operate Special Event Station W6FZZ in honor of Samuel F. B. Morse's birthday. Hours will be 1800 UTC–2400 UTC. Frequencies: 28.350 and 21.300 MHz phone, and 14.050 MHz C.W. QSL to *CLARA, PO Box 7675, Huntington Beach CA 92615.*

Number 5 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. Thank you for your cooperation.

I am looking for hams interested in starting a net for those interested in Cessna aircraft, particularly pre-1960 taildraggers. Also those interested in antique/classic aircraft of any manufacture, including home-builts. Contact *Scott A. Littfin N0EDV, 28579 County Rd. H, Webster WI 54893.*

Needed: Frequency modification for Heath SB—1400 for MARS or all-frequency operation. *Sean Connel, 4541 Longfellow, Sylvania OH 43560.*

I am looking for a power transformer for a SWAN 500 or a 117-XC power supply. Please call after 6 PM. *Ted Coats KA3TVZ, 4429 Baltimore Ave., Philadelphia PA 19104.*

Needed: A diagram and manual of the Hallicrafters SX-71, or reproduction of same, for which I will gladly pay all postage and duplication charges. I need information for alignment. Thank you very much. *Harry Evans, D.M.D., W4OFI, 10006 N.W. 81st Ct., Tamarac FL 33321.*

Wanted: ICOM FM Unit EX-106 for an ICOM 6 meter transceiver Model IC-551D. Contact *Piero A. Sassu N3FVG, 714 W. Marshall St., Norristown PA 19401.*

Wanted: Service manual and schematic for Realistic DX-300 shortwave receiver. Will pay costs. *Don Sylvain WA3WOD, 6021 Rossmore Dr., Bethesda MD 20814.*

Wanted: An Elmer. Nearest "Cities" are Tigard, Beaverton and Tualatin OR. I'm most anxious to get my Novice ticket and find some good, used equipment. *Toby Padgett, PO Box 23582, Tigard OR 97223.*

I'm trying to make a 2m digital setup out of flea market culls. Need schematic and/or manual for Simpson Model B marine radio, Computer Devices Teleterm 1030, and Ramtek 8025ag. Will pay copy cost, but write first. *Joel S. Look W1KCR, 35 Goff Ave. Apt. 507, Pawtucket RI 02860.*

MFJ gives you *all 9* digital modes

and *keeps on* bringing you state-of-the-art advances

. . . while others offer you *some* digital modes using 3 year old technology

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WITH MULTI-GRAY LEVEL MODEM
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MODEL MFJ-1278

MFJ-1278

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For dependable HF packet tuning, the MFJ-1274 gives you a high resolution tuning indicator -- and it's only $20 more.

New Easy Mail™ Personal Mailbox

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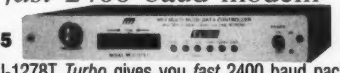
with *fast* 2400 baud modem

MFJ-1278T



$359⁹⁵

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Number 6 on your Feedback card

73 Review

by Bill Clarke WA4BLC

The Ten-Tec OMNI-V

So quiet you don't know it's running.

Ten-Tec, Inc.
Highway 411 East
Sevierville TN 37862
Phone: (615) 453-7172
Price class: OMNI-V HF Transceiver $2245
Options: 961 Power Supply, $239;
301 Desktop Tuner, $89;
705 Desk Mike, $69.

Ten-Tec recently introduced a new rig unlike any of the imports. In fact, there's no other rig like it on the market. This rig, the OMNI-V, is a super-performing, extremely quiet, "ham bands only" HF transceiver.

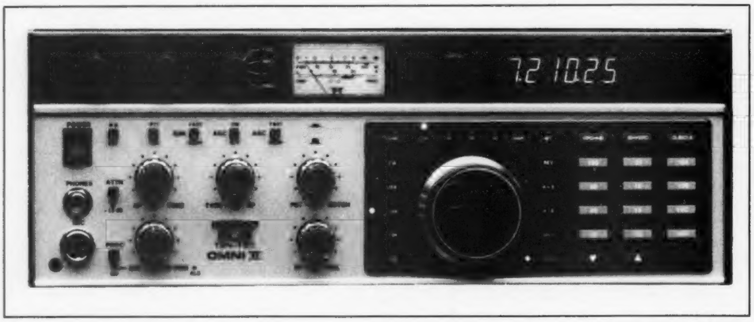

Photo A. The OMNI-V, showing the front panel layout. Notice the large digital display and large number of simple push-button controls.

The OMNI-V HF transceiver features microprocessor control (through an RS-232 port via computer, if desired), PLL synthesizer with crystal mixed oscillator, and 25 memories. The memory channel will hold the frequency, mode, and filter selection. Optional filters are available to suit any need. It also has a voice frequency announcer option and an internal clock/calendar.

Packaging Counts

The OMNI-V arrived in two boxes, one for the transceiver and one for the optional Model 961 power supply. The boxes are built to prevent any chance of damage during shipping, short of total crushing. Each unit was individually wrapped in plastic for further protection. After unpacking the transceiver and the power supply, I placed them on my desk to determine their final positions.

The OMNI-V, compared to many of the imported transceivers I have used, is formidable in size. But, unlike most imported transceivers this size, it's not a desk-crusher because it has an external power supply (with a speaker on its front panel). Not only does an external supply save weight, it also saves on internal heat buildup caused by built-in power supplies. A large set of fins on the rear panel take care of cooling. There is no fan to make noise or need replacement, but an external fan is recommended when running continuous full power (RTTY, etc.).

Front Panel

The OMNI-V's large digital display, consisting of blue fluorescent characters half an inch high, stands out. The second notable feature is the fine receive audio (more on this later).

There are enough controls on the front panel to allow tailoring of operation to suit nearly any operator or circumstance. In fact, there are 56 controls on the front of the OMNI-V, and a few others on the rear panel: VOX, SIDETONE, MONITOR, and various inputs and outputs, such as AUDIO, RTTY, and XVTR. However, most controls are simple push-buttons.

Nothing is difficult or unusual about operating the OMNI-V. With the exception of the memory section, an experienced ham can "plug in and play" the radio right away. After connecting the OMNI-V to the power supply and to my antenna system, I turned it on and tuned to my favorite portion of 75 meters.

Tuning In On the OMNI-V

The OMNI-V sent to me for review had all optional filters installed, the voice frequency announcer, and the optional remote tuning knob. I sampled every feature of the OMNI-V except RTTY, for which I currently have no equipment.

See Photo A. You select the band and control the memory from the keyboard on the right side of the front panel. From a column of switches directly to the left of the main tuning knob, you select the mode. You control the VFO from the column of switches to the right of the tuning knob, and select the filter from the row of switches above the tuning dial.

Receive and transmit variable controls, AGC, attenuator, processor, and noise blanker are all located on the left side of the front panel.

After selecting the band and mode of operation, you can quickly tune up/down with the up/down buttons, at 10 kHz per push. FAST tune selects a 30 kHz step.

The main tuning dial is large, has a hefty smooth feel, and a finger-hole. The digital display shows the current frequency down to 10 Hz. The 10 Hz digit can be disconcerting to the uninitiated, as it only takes a slight movement of the tuning dial to move 10 or 20 Hz. Selection of FAST tuning increases the tuning speed of the dial.

Memory usage required a little study of the operating manual, but once I learned, it was fast and easy. You can switch from VFO A to VFO B at the push of a button. Split operation is also available at the push of a button. The VFO in use is indicated on the display. Scrolling with the main tuning knob is a strong feature of the memory system.

The selectable filters system is great. Using the 2.4 kHz filter as standard for SSB reception gave excellent quality audio. When the going got tough, switching to 1.8 kHz dealt well with thick QRM. Using the 500 and 250 kHz filters really got me into the weak ones on CW. Selecting NARROW kicks in further filtering at the 9 MHz level and gives you steeper skirts on the passed signal.

For greater selectivity, you can add optional filters at the 9 MHz level to the existing 2.4 kHz filter. For example, you can install a second 2.4 kHz filter to give a total of 16 poles in this section.

The metering circuit displays FWD (forward), REF (reflected), Ic (final current draw), and PROC (processor) levels on a nicely backlit multi-scaled meter.

The BPF/FADE (bandpass filter) controls allow the user to tailor bandpass action to suit the situation. The amount of bandpass action is variable with a width of 35% of the selected center frequency at −6 dB points (from manual).

PBT (passband tuning) performed as expect-

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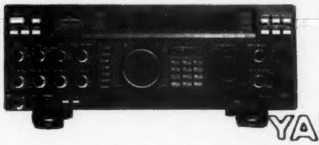

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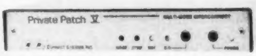

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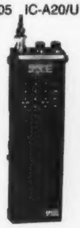

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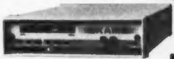

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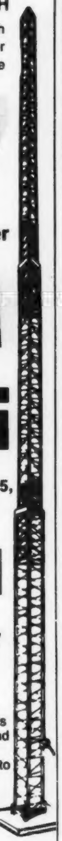

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ed, providing emphasized high or lows, and a good means of control over received audio. Receiver audio response can also be varied by the TONE control, although I found it to have only minimal effect.

There is no RIT (offset tuning) control. However, by using the alternate VFO (in split mode), you can effect a means of offset control. Although slightly different in operation from the RIT I am familiar with, it proved simple and effective.

AGC is selectable from the front panel. Being able to turn off the AGC when the noise of man (QRM) is strong, allowed adequate reception by manual control of AF and RF gain.

The NOTCH filter is very effective with its 50 dB depth, but like all other current production ham transceivers, it's sensitive to operate. I much prefer my Datong Automatic Notch Filter for removing carriers and heterodynes. I really would like to see the manufacturers pick up on automatic notch filters.

The Ten-Tec OMNI-V

General Specifications	
Frequency Range	160–10 meters in twelve 500 kHz segments 30 kHz over-shoot on band ends
Control	Microprocessor controlled digital PLL synthesizer with crystal mixer oscillator
Resolution	10 Hz
Display	7-digit fluorescent
Stability	1 PPM per degree C at 29.999 MHz (worst case)
Accuracy	±100 Hz at 25 degrees C
Power requirements	RX 1.5 A (13.8 VDC) TX 20 A (13.8 VDC)
Construction	Aluminum chassis, extruded front panel G-10 Epoxy PCBs
Dimensions	5.75 x 14.75 x 17 inches (HWD)
Weight	16 lbs.
Transmitter	
Modes	USB, LSB, CW, RTTY (FSK & AFSK), FM (optional)
DC Power Input	Max 200 W at 14 VDC CW, SSB, FM. 100% duty cycle for max 20 minutes (continuous w/auxiliary air cooling heatsink)
RF Power Output	25–100 W adjustable w/front panel control
Microphone	Low-Z (5 mV at −62 dB)
T/R Switching	SSB VOX/PTT, CW Fast/Slow QSK
CW Sidetone	Adjustable tone/volume
SSB Generation	9 MHz 8 pole XTAL filter w/balanced modulator
Carrier Suppression	60 dB typical
Unwanted Sideband Suppression	60 dB typical at 1.5 kHz tone
Spurious Output	>45 dB below peak power output
TX Antenna Output	50Ω unbalanced
Meter	Switchable forward power SWR Collector current Audio processing level
CW Offset	600 Hz
FSK Shift	170 Hz
SSB Monitor	Jack output
Receiver	
Modes	USB, LSB, CW, FSK/AFSK, FM (optional)
Sensitivity	SSB/CW/RTTY 0.15 μV at 10 dB S/N @2.4 kHz FM 0.30 microvolt at 12 dB SINAD @15 kHz
Selectivity	SSB Std 2.40 kHz at −6 dB, 3.36 kHz at −60 dB SSB Opt 1.80 kHz at −6 dB, 2.90 kHz at −60 dB CW Opt 0.50 kHz at −6 dB, 1.40 kHz at −60 dB CW Opt 0.25 kHz at −6 dB, 0.85 kHz at −60 dB FM Opt 15 kHz at −6 dB, 30 kHz at −60 dB
Attenuator	Approx. 20 dB
IF Frequencies	1st–9.0 MHz 2nd–6.3 MHz (FM 455 kHz)
RX Antenna Input	50Ω
Image Rejection	>60 dB
IF Rejection	>60 dB
Noise Blanker	On/Off adjustable width
S-Meter	50 μV at S9
Dynamic Range	97 dB typical
3rd Order ICP	+12 dBm
Squelch Sensitivity	<0.6 μV
Passband Tuning	±1.2 kHz
Audio Output	1.5 W at 8Ω with <2% distortion
Notch Filter	250–2.2 kHz 50 dB notch typical
Audio Bandpass Filter	4 pole Variable center frequency 220–1.7 kHz 35% bandwidth at −6dB Variable fader
Tone Control	Variable 15 dB rolloff at 5 kHz

QSK . . .

Here is where Ten-Tec shines. If you have never operated CW with full break-in, you must sit down and try it with the OMNI-V. You can clearly hear between the characters you send. No more throwing the TRANS switch and leaving it on until you go K. A real class feature.

The side tone is completely adjustable on the rear panel for pitch and level.

The speech processor passed the acid test of local and DX operation. I found it unobjectionable on local 75 and 40 meter operation, yet very effective, and it really punched out for DX and weak 10 meter working. All in all, the unsolicited audio reports I received were good to excellent. No one said, "Turn the processor off!"

The RF output control operates seperately from the MIKE gain control, and allows you to change your actual output power. This is perfect for controlling RF input to an amplifier.

On the rear panel is a MONITOR LEVEL pot that allows you to hear your own signal through the receiver's audio section. This is for setting speech processors and other audio controls for the transmitted voice signal. Headphones are required to prevent audio feedback.

The OMNI-V is current limited at 20 amperes. This prevents the final transistors from being damaged when the antenna system is not matched.

The clock/calendar feature is nice, although I had little use for it, as I have a wall clock in my station.

An external PTT jack on the rear panel provides for foot (or other) switches.

The operating manual is very complete, with a theory of operation, operating instructions, and circuit diagrams.

Looking inside the Ten-Tec will be a surprise to most modern transceiver users. There is space inside to work and move around. The boards are mounted apart, and plug-in wiring harnesses are used for interconnections. There is no crowding of components on the boards.

Receiver Audio Quality

Overall, the OMNI-V does extremely well with its receive audio. The internal speaker is more than adequate for most uses, and the optional power supply with its built-in speaker is even better. SSB signals seem to have a certain "audio presence" lacking in most of the other rigs on the market. This high quality audio was even more emphasized when I feed the OMNI-V's output to my station audio system.

I am a heavy user of 75 meters during the night hours, and as such I must live with the summer static levels. The OMNI-V hears through this junk better than any receiver I have ever operated. I tried duplicating this reception with my other rigs, using various

AT-3000 Antenna Tuner
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ANTENNA SELECTOR
1 DIRECT
2 DIRECT
1 TUNED
BALANCED ANTENNA

AEA's TUNING PERFECTION 300W AND 3kW TUNERS

For tuning perfection, choose AEA's AT-300 300 watt or AT-3000 3 kW antenna tuners. Quality and exceptional engineering are built-in for maximum performance.

Easy Operation. The built-in front panel antenna switch allows you to easily select two unbalanced (coax-fed) antennas, a dummy load or a balanced antenna. Both the AT-300 and AT-3000 are easy to use.

Peak Reading Meter. The AT-3000 features a peak and average reading cross-needle meter which shows forward power, reflected power and SWR. High and low power is selected from the front panel to select the proper range for the SWR meter. Minimal SWR is achieved by inductors with 18 (AT-300) and 20 (AT-3000) taps created by AEA's exclusive patent pending CAM switch design for accurate tuning. AEA's tuners also tune a wider range of antenna impedances. There are limitless possibilities to create the best match.

Larger Size. Why are the AT-300 and AT-3000 so large? Because it improves the inductors' Q (quality) factor for high efficiency. High Q means low insertion loss which guarantees that maximum power is delivered to the antenna. Tests with some roller coil antenna tuners show insertion loss as high as 20dB on some amateur frequencies. Don't be fooled into believing that a low SWR is the key reason for using an antenna tuner! The primary reason is for maximum power transfer from the transmitter to the antenna. An SWR of 1.5 to 1 or better is usually all that is necessary to "make the transmitter happy." Remember that you can get 1 to 1 SWR with just a dummy load. AEA's two coil design also provides harmonic reduction, maximum power transfer and a wider range of impedance matches.

300 or 3,000 Watts. The AT-300 watt continuous duty cycle tuner has been tested at 1 kW with a 50 ohm load, so you can rest assured that there's no problem operating the AT-300 at 300 watts. And the AT-3000 is rated at 3 kW. AEA stands behind its specifications.

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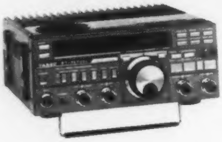

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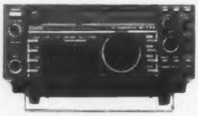

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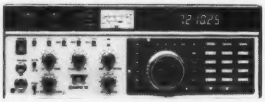

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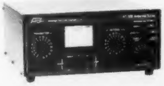

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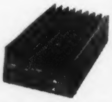

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speakers and filters. I was not successful. The OMNI-V does not hear static crashes well, and that's fine with me.

I asked other operators to listen to the receiver, then asked them what they liked about it. Each mentioned the "presence" of the received signals and the general lack of QRN.

To compare the OMNI-V to a typical PLL-based transceiver, I used my ICOM IC-751A. I found that on the ICOM, a typical 59 + 10 dB signal on 75 meters could be difficult, or at least uncomfortable to copy, when the static crashes were rolling in at 15 to 20 over S9. Switching to the OMNI-V and listening to the same 59 + 10 dB signal, the static crashes were reduced to below the 10 dB level and the copy was significantly improved.

This silent effect is quite similar to switching from a PLL-based transceiver to an older tube-type rig, such as a Collins or Drake, under the same noise conditions. Unfortunately, the latter rigs offer none of the niceties of solid state microprocessor based operation.

Praises—What I Like the Most

1. I cannot say enough about the quality of the receiver audio. It is absolutely excellent.
2. The large digital display is very easy on the eyes; you can read it from across the room.
3. The voice frequency announcer eases operation for the visually impaired.
4. Ten-Tec has provided a real relay for controlling linear amplifiers (including older ones).
5. Memory RAM and the microprocessor operating system do not require a backup battery (the clock/calendar does). This feature can be very important. For example, my ICOM 751A must have the microprocessor reprogrammed if the lithium backup battery fails.
6. The OMNI-V is a CW operator's dream.

Yawns—OK

1. The clock beeps at 16 minutes past the hour to remind the operator that WWV propagation information is being sent on 10 MHz. I personally found this to be annoying, but someone else may find it a valuable reminder.
2. The TONE control lacks authority.
3. The clock/calendar feature is not necessary.

Boos

1. An S-5 birdie breathes fire at 21.330 MHz (factory aware of this problem).
2. The VFO tuning knob needs a dial lock.
3. There are no provisions for AM operation (not a problem for most operators).
4. The plastic base of the desk mike is too light in weight.

Warranty Service

Normally, I wouldn't include warranty information about a new piece of equipment, but just read this quote from the Ten-Tec warranty page:

WE ENCOURAGE SELF HELP. Taking the covers off does not void the warranty. In many cases our customer service technicians, with your help, can identify a faulty circuit board or part. When appropriate, we will send you a replacement board which you can change. This will be shipped on a 30 day memo billing, and when the defective board is returned, we will issue a credit.

Having been in the service end of ham radio for a very long time, I can state emphatically that you will get no similar service from any other manufacturer of ham equipment.

The Secret of Silence

Ten-Tec has been extremely careful in designing the interaction of the crystal oscillator and LO mixer. Phase noise in the OMNI-V depends entirely upon the design of the 5.0–5.5 MHz synthesizer. In practice, the synthesizer is actually two loops operating at 200–220 MHz, tuning in 400 Hz steps, and divided by 40 to produce the necessary 5.0–5.5 MHz output. The division by a factor of 40 reduces the output frequency; but more importantly, it reduces the phase noise and spurious levels by a factor of 32 dB. That is, it's 32 dB quieter than a normal PLL-type circuit.

The synthesizer's output signal of 5.0–5.5 MHz is then mixed with the output from the crystal oscillator and filtered through a bandpass filter, amplified, and then filtered through a 9 MHz notch filter. Crystal and filter selection is microprocessor based.

The receiver is inherently quiet due to the PLL-based VFO and use of crystal oscillator mixing circuits, versus the typical PLL-only circuitry found in most current HF receivers/transceivers. By employing crystal oscillators and mixing circuits for band selection, a large percentage of internally generated noise is eliminated.

Crystal mixing circuits are limited in bandwidth to the excursions allowed by the VFO. In this particular case, the standard VFO output of 5–5.5 MHz is derived from a PLL circuit and mixed with various crystal oscillators to arrive at specific bands. Each band is limited to a 500 kHz width. Band selection and switching of the desired oscillator and mixer circuits are done by microprocessor controlled circuitry.

Because of this care in design, the OMNI-V is a real performer with some of the finest receive audio I have ever heard on any ham equipment.

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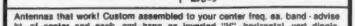

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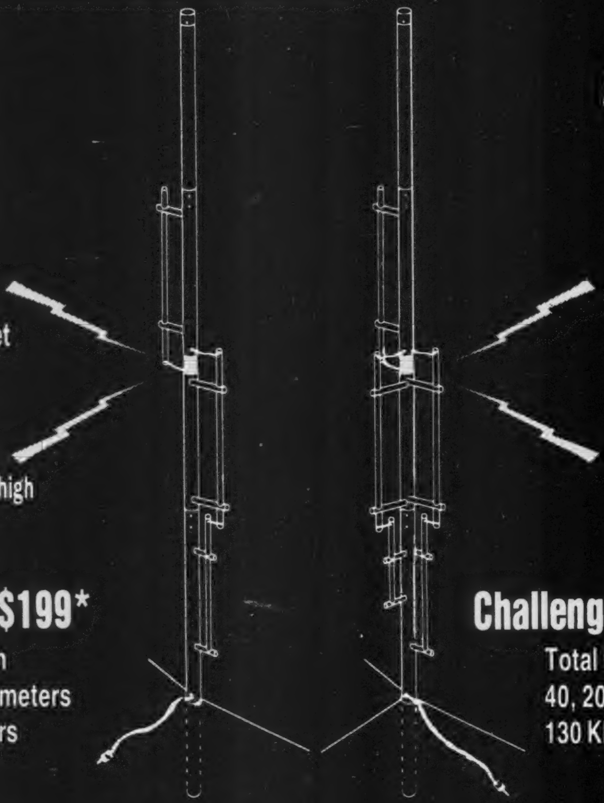

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In our continuing effort to present the best in amateur radio features and columns, we recognize the need to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed here. These numbers correspond to those on the feedback card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

Do we really read the feedback cards? You bet! The results are tabulated each month, and the editors take a good, hard look at what you do and don't like. To show our appreciation, we draw one feedback card each month and award the lucky winner a free one-year subscription (or extension) to *73*.

To save on postage, why not fill out the Product Report card and the Feedback card and put them in an envelope? Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 25 cents!

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HAM PROFILES

There are no "average" hams!

Photo A. Tom Comstock shaking hands with Kevin Biekert KB5AQV, with Alan Cross standing by. Along with a plaque, the Hiram Percy Maxim Memorial Award included a check for $1,000.

Award-Winning Ham

Kevin Biekert KB5AQV, a senior at Clear Lake High School in Houston, Texas, received his first amateur radio operator's license when he was 15, and less than two years later, he earned his Extra. A wall full of certificates won in contests and special events testifies to Kevin's enthusiasm.

In November 1989 at the HamVention in Houston, the ARRL presented Kevin with the Hiram Percy Maxim Memorial Award. This award is given annually to a ham under the age of 21 who best exemplifies the ideals of amateur radio: service, communication, and experimentation.

Kevin helped establish the Clear Lake Amateur Radio Club (CLARC), which has grown from seven to over 150 members. During Hurricane Chantal, Kevin helped with emergency communications. Recently, he has been assistant teacher in a Novice class.

Almost every Saturday evening for the past two years, Kevin, sometimes with friends and family (both his parents are hams), enjoy QSOs with Serge RA9YK, Len, and other friends in Barnaul, Siberia. These talks have led to an exchange of information, pictures, books, flags, and most important, friendship. By the time you read this, Kevin and his family will probably have visited their friends in the Soviet Union, as their trip was scheduled for March.

(Submitted by Jim Heil KB5AWN and Bob Biekert KA5GLX, editors of CLARC Chronicles.*)*

Photo B. Steve Mindy KF8CP, a handsome young ham, is studying for FEMA certification.

There's No Stopping This One

Thirteen isn't an unlucky number for Steve Mindy KF8CP. Thirteen months after passing the tests for his Novice license, Steve earned his Extra—on his 13th birthday.

Before his family moved to the Detroit area last summer, Steve (ex-N2IYA) was a familiar voice on the repeaters around Buffalo, particularly on the traffic nets. His proficiency as a traffic handler received recognition in the spring of 1989 when he was appointed an ARRL Official Relay Station. At that time he was a seventh-grade student in East Amherst, New York.

Not one to be content with chatting on the repeaters and DXing on 10 and 20 meters, Steve is currently studying for Federal Emergency Management Agency certification so he can get involved with RACES activity.

Currently, he's helping a neighborhood fourth-grader study for his Novice ticket.

(Submitted by Jack Mindy KF8CY.)

Photo C. Last Christmas, Arthur Tan AB4RL—yet another handsome young ham, took a break from DXing long enough to open his presents.

Ham Son Hooks Dad

Arthur Tan AB4RL, Extra Class amateur radio operator, became interested in radio after joining the Boy Scouts. He was fortunate to have Don Williams AB4IO as his scoutmaster.

Arthur and his father, Peter Tan, enjoy going to hamfests and getting ". . . lost in a sea of colossal fraternity." And what does his dad hear the most about from AB4RL? DX! He talks about countries his dad has never heard of before. "Contests are a killer around here," Peter Tan writes. "I hear Morse code at the oddest hours of the morning. I think I'm dreaming, but then I realize it's my son chasing another new country. . ."

Arthur shares his interest and enthusiasm with anyone who will listen, including his father. Apparently he's succeeded with the latter; Peter Tan writes, "We are in the process of getting a tower and beam up. I think that will be fun." Arthur has also taken part in teaching at the local community school, and in the fall of 1989, Arthur was involved in the area Field Day at the IBM Radio Club and SFDXA N4TL operation.

Besides radio, Arthur is interested in tennis, music, and computer programming. He plays the piano, violin, and trombone.

Here are some parting words from Peter Tan to inspire all young hams who hope to hook Mom or Dad: "I must admit that ham radio has made me, my family, and most of all my son a better person."

(Submitted by Peter C. Tan, ham-to-be.)

10 GHz Fun

Easy way to get on the 3cm band.

by C.L. Houghton WB6IGP

Want a cheap and easy way to get on 10 GHz? This 30 MHz IF strip and modulator allows you to put together a very inexpensive system for 3 cm operation. Combine this transceiver with a Gunn oscillator and a Polaplexer mount attached to a small dish antenna, and you are ready to go! (See the October 1987 issue of *73 Magazine* to learn how to build the Polaplexer mount.)

Overview

Let's look at what is required for a complete system operating on 10 GHz. The October article describes the Polaplexer detector and circular waveguide to which is coupled a Gunn oscillator. I used the Solfan alarm type available from many burglar alarm companies. *[Ed. note: Solfan, now defunct, also had a broad line of passive infrared detectors used in intrusion detectors and as actuators for door openers. Don't try to convert an infrared detector using these techniques.]* Being inexpensive, it is not varactor controlled. Adding just a power supply modulator and IF amplifier operating at our IF of 30 MHz complete the package! Figure 1 is a block diagram of the complete 10 GHz system.

Transmitter Circuitry

The transmitter consists of a single Gunn oscillator unit. Many different types exist. The best known unit is made by Solfan, and it can be found throughout the US and Canada.

The output power of an unmodified Gunn oscillator cavity runs about 10 mW. (I recently modified these cavities with high power Gunn diodes that have a power output of about 100 mW. I will make these available soon.) The Gunn oscillator is supplied with about 10 VDC (positive for the Solfan) from a variable voltage regulator. This regulator is modulated by a single CA-3130 op-amp serving a microphone amplifier. (The LM-386 and CA-3130 are available from Jameco.)

Now see Figure 2. The output of the microphone amplifier is capacitively coupled through a deviation control (variable resistor) to the voltage-adjust terminal of the power supply regulator. A small variation in audio voltage on this adjust terminal varies the voltage of the power supply which in turn varies the operating frequency of the Gunn oscillator, providing FM. An option on the PC board allows use of Gunn oscillators that have varactor frequency control.

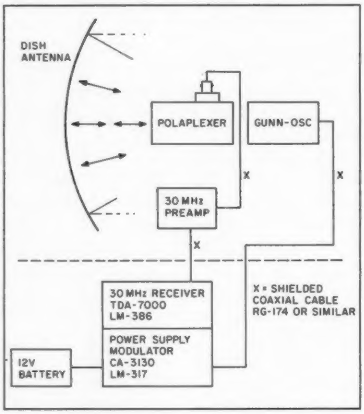

DISH ANTENNA
POLAPLEXER
GUNN-OSC
X
X
30 MHz PREAMP
X
30 MHz RECEIVER TDA-7000 LM-386
X = SHIELDED COAXIAL CABLE RG-174 OR SIMILAR
POWER SUPPLY MODULATOR CA-3130 LM-317
12V BATTERY

Figure 1. Block diagram of the complete 10 GHz system.

Kelly N6IZW operating the W6OYJ Polaplexer and 10 GHz SSB transceiver from the top of Mt. Soledad in California, while several other members of the San Diego Microwave Group look on. The transceiver drives a 10W traveling wave tube (TWT) amplifier. They made a contact over a 174 mile path, to a receiving system on Mt. Pinos. [Photo by author.]

Receiver Circuitry

Figure 3 shows the WA6EXV 30 MHz 40673 FET preamp. The output of the Polaplexer detector diode (MA/COM 1N23WE) is coupled to the input of the single chip receiver system, operating at 30 MHz. For first-time operation, the detector and receiver can be connected together. You can improve operation, however, by adding an IF preamplifier between the detector diode and the 30 MHz IF amplifier-receiver. I tried several types of preamplifiers and use either a U-310 grounded gate FET or a 40673 FET. When the full system was tested on a noise meter at 10 GHz, the system noise figure was about 12 to 14 dB.

The heart of the IF amplifier is a Signetics TDA-7000 single-chip receiver. This chip has an input sensitivity of 5 microvolts for full quieting and is capable of operation directly to about 120 MHz. I am really impressed with this chip in that it operates with very few external components and does its job so well. It's hard to believe that this one chip converts the 30 MHz IF signal direct to headset level audio. This unit is an improved version of my original receiver IF amplifier that appeared in *73 Magazine* in October 1986. Operation of the unit was quite good and provided the vehicle to easy construction and operation on the 10 GHz "X" band or other microwave frequencies.

This article updates the original unit and adds several unique features. Before, when operating the IF amplifier with several stations on 10 GHz, there was no easy way to offset the 30 MHz IF strip to allow for incremental tuning. This was needed, however, to keep the Gunn transmitters on frequency and compensate for small frequency errors in the receiver IF amplifier. This

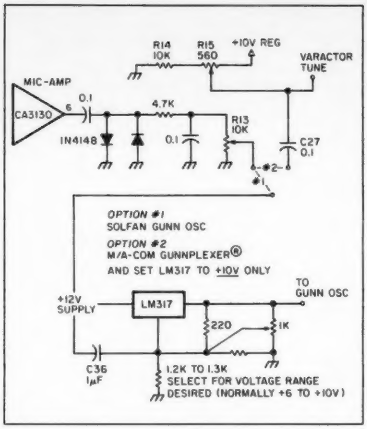

R14 10K
R15 560
+10V REG
VARACTOR TUNE
MIC-AMP
CA3130
6
0.1
4.7K
R13 10K
IN4148
0.1
C27 0.1
#2
#1
OPTION #1
SOLFAN GUNN OSC
OPTION #2
M/A-COM GUNNPLEXER®
AND SET LM317 TO +10V ONLY
+12V SUPPLY
LM317
TO GUNN OSC
220
1K
C36 1µF
1.2K TO 1.3K
SELECT FOR VOLTAGE RANGE DESIRED (NORMALLY +6 TO +10V)

Figure 2. Microphone input modulation circuit.

was due to the 30 MHz IF not being exactly centered on 30 MHz on all units. Without it, you would continually adjust your Gunn's voltage slightly to improve reception clarity and both stations would soon "walk" each other out of sight, in continually adjusting frequency to make up for this difference. To compensate for this, a varactor diode was installed on the oscillator coil of the IF amplifier and adjusted by a pot on the front panel to change the IF frequency for a RIT offset. This allowed fine frequency netting of both stations and removed one drift problem from this transceiver's operation.

Users also soon begin to want a smaller PC board to make a more compact system. Additionally, there was no provision for making the unit adaptable to the very fine MA/COM Gunnplexers available from Microwave Associates. In this updated version, I wanted to make this unit useful for home-brew construction. After all, the main object is to have a lot of fun operating a home-constructed, inexpensive 10 GHz transceiver.

The Signetics TDA-7000 chip is really very simple. All that is required to put the chip into operation is setting the oscillator coil to the desired frequency. The low power output from this circuit is not easily detected by a grid dip meter, so I usually set receivers up by injecting a signal at the desired IF of 30 MHz.

If you live in an area with modest power FM broadcast stations nearby, as I do here in San Diego, you can touch the input pin with any metal object and hear a multitude of FM broadcast stations that are harmonically related to the oscillator frequency. Proper shielding and limiting the input to 30 MHz solves this problem.

The remaining functions are supported by fixed values of capacitors tied from the chip's pins to +5 volts not grounded. This might seem odd to most, but I assure you, it is proper. The circuitry on board the chip has an internal oscillator, mixer, IF limiter-amplifier, and a demodulator with a frequency locked loop operating at an IF of 70 kHz. Toss in about a dozen external capacitors, a few resistors, and a coil, and you have a complete basic system with operation to over 100 MHz. By selecting various values for a few components, the bandwidth can be changed from 4.5 kHz to about 75 kHz. The unit as shown in the schematic (Figure 4a) is set up for 25 kHz bandwidth. Table 1 shows the component values for different bandwidths.

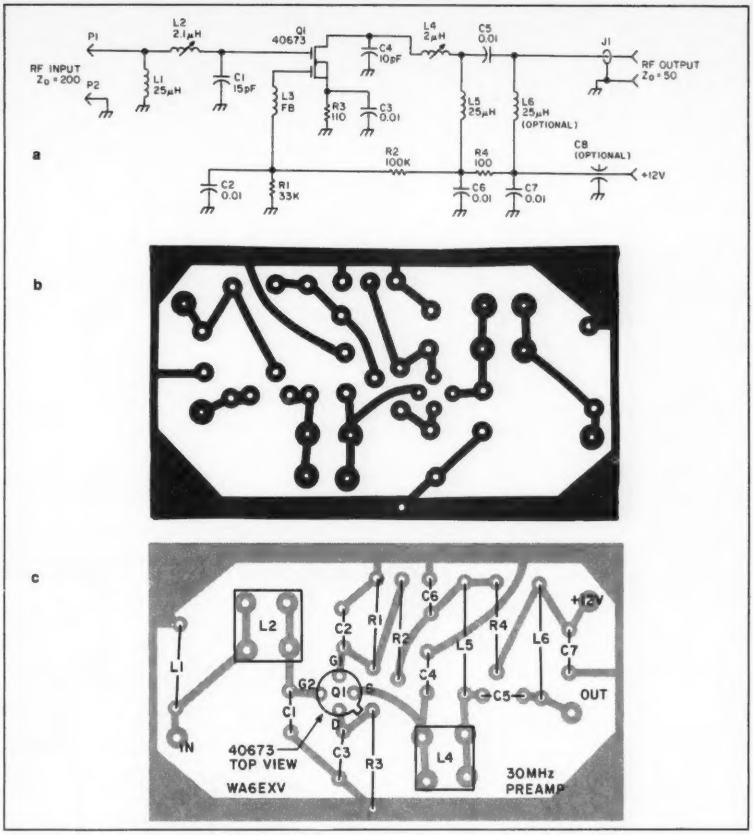

a
P1
RF INPUT Z₀=200
P2
L1 25µH
L2 2.1µH
C1 15pF
Q1 40673
L3 FB
R3 110
C3 0.01
C4 10pF
L4 2µH
C5 0.01
J1
RF OUTPUT Z₀=50
L5 25µH
L6 25µH (OPTIONAL)
C8 (OPTIONAL)
R2 100K
R4 100
+12V
C2 0.01
R1 33K
C6 0.01
C7 0.01
b
c
L2
L1
C2
R1
R2
C6
R4
L5
L6
+12V
C7
G1
G2
Q1
S
D
C4
C5
OUT
C1
C3
R3
L4
IN
40673 TOP VIEW
WA6EXV
30MHz PREAMP

Figure 3. (a) Schematic, (b) PCB foil diagram, and (c) parts placement for the 30 MHz preamp.

Reliability

Of over 100 units locally home-brewed, fewer than 5% failed. Only two had defective ICs; most of the other failures were simple oversights in building.

There is always one unit that defies gravity. Such a unit was shipped to me for repair after I could not isolate the trouble over the telephone. It drove me nuts! I replaced quite a few suspicious components, including the TDA chip, and it still did not work. All voltages seemed proper, but the chip just would not function at RF. In desperation, I used the chip in another receiver board. This proved the chip good, so the trouble was on the board. On detailed inspection, I found that the unit had been put together with *acid-core* solder. This is a paramount no-no! It looked good but had high leakage all over the board. After giving the board a complete cleaning, resoldering with rosin solder, and degreasing with lacquer thinner, it performed quite well.

PC Description

In addition to the IF 30 MHz receiver, the printed circuit board contains a small audio amplifier, S-meter circuitry, and a microphone amp (see Figure 4b). This makes for a crowded PC board. Additionally, there are the power supply regulator chips for the 5 volt, 10 volt, and Gunn diode supplies. The circuit board is double-sided: the top foil acts as a ground plane, the bottom foil is the actual circuit. I prepared the printed circuit board by first drilling all holes that do not require grounding to the top ground foil surface. (I used a #65 bit, about 0.035 inch. Drill bits costing about 50¢ are available from model train (HO) hobby stores.)

After drilling all holes that are not to be grounded, I reamed out the top ground foil with a larger drill, 3/16" or so, giving a clearance around the component leads when inserted on the board. Once the reaming for the non-grounding holes was completed, I drilled the remaining holes. These were not reamed out allowing the grounding leads to be soldered to the top *and* bottom foils. This gives the very short low inductance ground leads, making for very stable operation.

PC Board Assembly

I usually install the resistors first to get the lay of components on the PC board. Once a few parts have been placed on the board, the

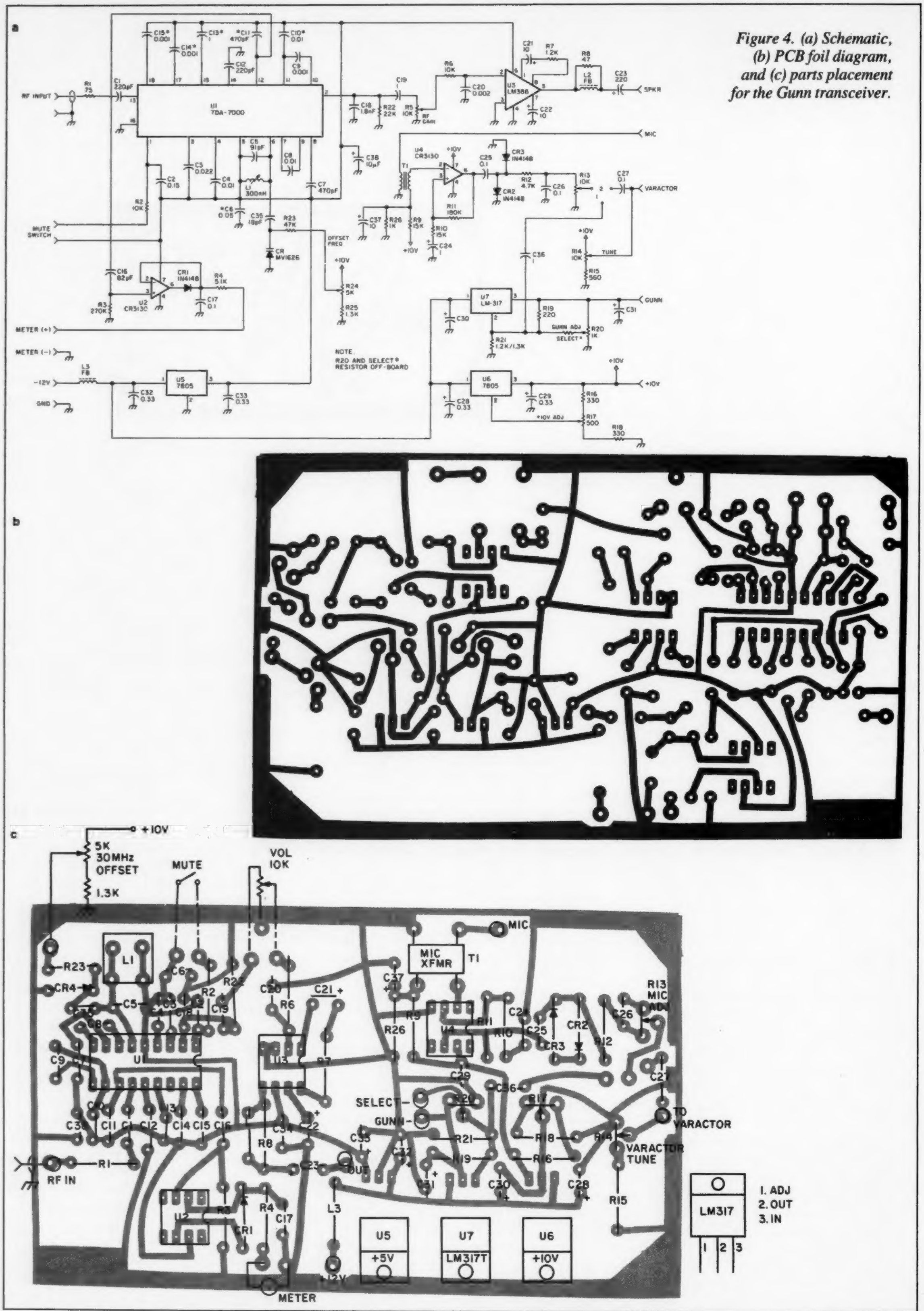

a
b
c
RF INPUT
U1 TDA-7000
U2 CR3130
U3 LM386
U4 CR3130
U5 7805
U6 7805
U7 LM-317
MUTE SWITCH
METER (+)
METER (−)
−12V
GND
SPKR
MIC
VARACTOR
GUNN
+10V
OFFSET FREQ
RF GAIN
TUNE
GUNN ADJ SELECT*
+10V ADJ
NOTE
R20 AND SELECT* RESISTOR OFF-BOARD
+10V
5K 30MHz OFFSET
1.3K
MUTE
VOL 10K
MIC
MIC XFMR
T1
R13 MIC ADJ
SELECT
GUNN
TO VARACTOR
VARACTOR TUNE
RF IN
METER
+12V
U5 +5V
U7 LM317T
U6 +10V
LM317
1. ADJ
2. OUT
3. IN

Figure 4. (a) Schematic, (b) PCB foil diagram, and (c) parts placement for the Gunn transceiver.

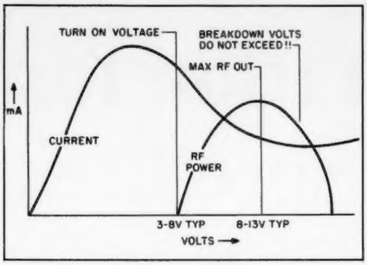


Figure 5. Gunn diode I/V curve.

rest is simpler. After most of the components are assembled on the PC board, check the power supplies for proper operation before mounting the chips. (I mount the TDA-7000 last.) Primary power for the unit is provided by either an external or internal 12 volt battery. I hooked a five-foot-long connecting cord to a surplus 2½ Ah lead-acid battery similar to the size of a motorcycle battery. The capacity allows many hours of continuous operation without recharge.

The 5 V supply is standard with a 7805 +5 V regulator. The Gunn power supply uses a LM-317 adjustable voltage regulator, providing 6 to 10 V adjustable for frequency control, and has audio modulating its adjust terminal. The 1k adjust pot (R20) and its fixed limit (select) resistor are mounted off-board, allowing front-panel frequency adjust for use with non-varactor cavities. In its use as supply to a varactor-type cavity, the voltage of the LM-317 is fixed at 10 V and the microphone output deviation control is coupled to the varactor voltage tune line for transmitter modulation. See Figure 2. The main reason for using fixed resistors in the adjust circuit of the LM-317 is that more than 12 V may destroy your Gunn diode. In the event of high battery voltage, the LM-317 limits the voltage to a level that is safe for the Gunn diode.

The 1k tuning pot is set with the series resistor (select) to limit the voltage range to a maximum of about 10 V. You can omit the two extra resistors, using just the 220Ω, and replace the fixed adjust resistor with a single variable. The +10 V supply uses a 7810 fixed regulator. However, you could use a single 7805, referenced above ground, allowing it to provide other than its normal +5 V. It holds down costs and doesn't provide high currents, so it works very well in this application. Most of the regulators can be obtained at Radio Shack. The 7805 is RS #276-1770, and the LM-317 is RS #276-1778.

Alignment

After power supply check-out, give the PC board a once-over, and when satisfied all is proper, apply power. The slug in the core of the ⅛" coil form of the TDA-7000 oscillator circuit will be adjusted first. You might want to enable/disable the mute line by connecting +5 V to the mute line 10k resistor. Connect a signal generator to the input of the IF amplifier receiver and find out where the device is tuned to. Once you have found the point where the receiver is operating, adjust the slug in the core to alignment at 30 MHz. If you can't obtain operation at 30 MHz, you might have to pad your coil with a capacitor on the bottom of the PC board to bring it to frequency. (I used a ⅛" adjustable coil form with 12 turns of #24 wire.) This adjustment is done with the varactor in place and the tune (RIT) control set to approximately mid-position. I used a 1N5141/1N5142 varactor, 12/15 pF respectively. Any similar low-capacitance varactor diode will work here.

Frequency Calibration

When the final frequency calibration is completed, you should obtain a signal that is full-quieting from about 5 μV. I do not have an FM generator, so I use a surplus URM-26 (AM generator) for check-out on my work bench. Operation of the S-meter circuit can be checked and calibrated with your signal generator for an indication of what μV sensitivity is indicated on the S-meter for future reference. You might want to connect your preamp for these measurements.

Gunn Safety

After the receiver is performing as needed, fire up the Gunn oscillator. A Gunn oscillator can be checked out without any complex instruments, to at least determine if it produces RF. One word of caution: Don't look into the open end of any waveguide system when it is radiating; the microwave radiation can injure your eyes. With low power devices, the safe distance is a few feet, but always use caution. Others might not know about the dangers. Safety first!

Again, it's easy to tell when a Gunn oscillator is oscillating. Connect a current meter in series with the power supply line and turn on the power. Preset the output voltage to about 5–6 volts, as the Gunn devices draw maximum current at very low voltages. With the normal Solfan 10 mW diode in place, use 9–10 volts. Wave your hand in front of the cavity opening and watch the current meter. This detunes the cavity and changes the operating point of the Gunn diode. It should affect the current being drawn. A crude method, yes, but it works on the bench, giving a quick indication of Gunn operation.

Gunn Diode Notes

Gunn devices draw maximum current at low voltages, so avoid these voltages. A Gunn's resistance does not read like a standard diode front-to-back ratio, but looks more like a 2–3Ω resistor. (Caution: Gunn diodes are voltage-polarity sensitive.) As the voltage slowly rises, a point is reached where oscillation starts. Further increase in voltage produces an increase in output, up to a point. Beyond this point (maximum RF output), increasing voltage produces a decrease in RF output. Going much above this point destroys the Gunn device. See the I/V curves in Figure 5.

Transmitter Operation

The transmitter (Gunn oscillator) connects to the Polaplexer detector mount, and the detector output connects to the input of the 30 MHz IF amplifier. If you use coax connectors to break the cables, use different types, or mark the coax cables to prevent supplying 10 volts to the mixer diode and destroying it. When powered up, you should see about 0.8 mA of current on the mixer diode when the injection screw is set for proper mixer injection. All that is required to use the system is another unit to put into full duplex 10 GHz operation.

In the Field

The Polaplexer/transceiver system has gone on countless outings, and performed very well. One advantage to the Polaplexer system is that you can quickly change—in just a few seconds—the polarization for either vertical or horizontal operation. Our organization, the San Diego Microwave Group, has settled on a vertical mode of operation.

On a recent DXpedition to a nearby hilltop, several transceivers were set up and many contacts made. Our Big Gunn system was in operation using narrowband SSB on 10.368 GHz, feeding to a traveling wave tube (TWT) and producing several watts of power on 10 GHz. Our group's best SSB DX contact to date is 174 miles. About 10 days later, Don WB6FWE on Mt. Pinos and Jack N6XQ on Mt. Soledad made contact using Solfan Gunn units and our transceiver board, for a wideband FM contact over the same SSB path—174 miles. I think that sets a record for Solfan use that will be hard to beat, considering the very modest units involved.

Parts Kit

I have a kit of new parts available with a PC board etched and ready for drilling. The parts kit includes the TDA-7000 chip, some Mylar™ capacitors, and the ferrite bead used in the audio circuit. I usually include a few other parts I have on hand as well. The basic kit cost with PC board is $10 postpaid. I will supply varactors, if needed, for $1 each. I also have a supply of high-output Gunn diodes providing 50 to about 100 mW at 10 GHz. Six and 18 GHz devices are also available. I test all devices prior to shipment and furnish specs. Cost of the Gunn diodes is $5 each; $10 each for premium devices with power out of 100 mW and up. I will be glad to answer any questions concerning this project or any other related microwave subject. For a prompt reply, include an SASE. Chuck WB6IGP, San Diego Microwave Group, 6345 Badger Lake Dr., San Diego CA 92119.

Component	Bandwidth		
	75 kHz	25 kHz	4.5 kHz
C8	3300 pF	0.01 μF	0.1 μF
C7	180 pF	500 pF	2200 pF
C9	330 pF	1000 pF	4700 pF
C10	3300 pF	0.01 μF	0.1 μF
C11	150 pF	470 pF	3300 pF
C14	330 pF	1000 pF	4700 pF
C15	220 pF	620 pF	3900 pF
Bypass			
C6	0.01 μF	0.1 μF	0.1 μF
C15	0.1 μF	1 μF	4.7 μF

Table 1. Values for changing bandwidth of TDA-7000. Compiled by WA6EXV.

A Mode B Ground Station for AMSAT's Phase III Satellites

Build your own station to track OSCAR 13!

by Timothy R. Kearney ND9T

Amateur satellite communications offers both a challenge and a reward to those who answer its call. The challenge is to construct a station which will locate, track and communicate through a satellite that is thousands of miles above the Earth. The reward can be finding other amateurs in Germany, India, Japan and Venezuela who have also accepted the challenge. I'll explain how to set up a "Mode B" satellite Earth station. Collecting the reward is up to you!

Table 1. Mode B Frequency Plan for OSCAR-10

(Frequency in MHz)

Uplink	Downlink
	145.987 Engineering Beacon
435.045	145.960
435.050	145.955
435.060	145.945
435.070	145.935
435.080	145.925
435.090	145.915
435.100	145.905
435.105	145.900 CENTER
435.110	145.895
435.120	145.885
435.130	145.875
435.140	145.865
435.150	145.855
435.160	145.845
	145.810 General Beacon

Table 2. Mode B Frequency Plan for OSCAR-13

(Frequency in MHz)

Uplink	Downlink
	145.985 Engineering Beacon
435.423	145.975
435.433	145.965
435.443	145.955
435.453	145.945
435.463	145.935
435.473	145.925
435.483	145.915
435.493	145.905
435.508	145.890 Center
435.513	145.885
435.523	145.875
435.533	145.865
435.543	145.855
435.553	145.845
435.563	145.835
435.573	145.825
	145.812 General Beacon

Satellite communicators have adopted their own language. For those of you just entering this arena, I have included a short list of definitions to help you understand some of the terminology in this article. See the "Glossary."

Building the Ground Station

A Mode B station is an achievable goal for many radio amateurs. Mode B describes a satellite system whose uplink signal is in the 70cm band (435 MHz) and whose downlink signal is in the 2m band (145 MHz). AMSAT OSCARs 7 and 10, as well as the latest Phase III satellite, AMSAT OSCAR 13 (AO-13), have Mode B transponders on board. Table 1 illustrates the frequencies used for uplink/downlink on OSCAR 10. Table 2 illustrates the frequencies for OSCAR 13.

The most important element of the ground station is the receiver. Lack of a good receive system can drive up costs by requiring greater antenna gain, transmit capability, and system complexity. After all, if you can't receive the satellite's signal, there's not much point in having the rest of the station! My advice is that you expend the greatest effort designing the receive link. (I don't mean to slight the transmit link—it too plays a key role in satellite communications.)

A successful Mode B station needs a good quality, low loss transmission line because of the attenuation or loss of signal energy experienced at 145 MHz and above. You'll also need aiming information to locate the satellite and steer the directional antennas. Finally, some understanding of the operating practices and schedule is necessary for effective satellite communications. I will outline each of these topics in some detail.

Receive and Transmit Antennas

Antennas for receiving and transmitting are a good place to start when describing a ground station installation. These antennas may vary from a monopole to a yagi to a parabolic dish. In all cases, the more gain or directivity that an antenna displays, the greater the need for an accurate mechanism to aim the antenna.

The receive link antenna for mode B should be optimized for operation near 145.9 MHz. AMSAT recommends a receive antenna with a gain of at least 10 dBi (10 dB gain over an

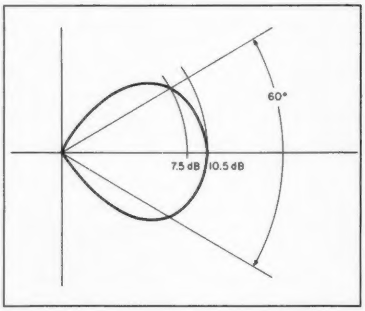


Figure 1. Antenna pattern in two dimensions. This antenna has 10.5 dBi gain and a half-power (−3 dB) beam width of 60 degrees.

GLOSSARY

AMSAT—Radio Amateur Satellite Corporation.
Apogee—The point of the orbit where the satellite is farthest from the geocenter of its orbit.
Azimuth—Angle in the local horizontal plane measured clockwise with respect to North.
Downlink—A radio link originating at a satellite and terminating at one or more ground stations.
Elevation—Angle above the local horizontal plane.
Inclination—The angle between the orbital plane of a satellite and the equatorial plane of the Earth.
Isotropic—A hypothetical source in free space that radiates equally in all directions.
Mode—The combination of transmit and receive frequencies used by a satellite's transponder.
Noise Figure (NF)—A figure of merit, measured in dB, describing noise performance.
Orbit—The path a satellite follows as it circles the Earth.
OSCAR—Orbiting Satelite Carrying Amateur Radio.
Perigee—The point of the orbit where the satellite is closest to the geocenter of its orbit.
Satellite pass—Segment of the orbit when a satellite "passes" within range of a ground station.
Uplink—A radio link originating on the Earth and directed at a spacecraft.

isotropic antenna). Several beam-type antennas (yagi, loop, helix, etc.) will satisfy that requirement. A beam antenna achieves its gain by directing or shaping the radiation pattern of the antenna. Figure 1 illustrates how an antenna directs its energy (in two dimensions). The antenna shown in Figure 1 has a gain of 10.5 dBi and a 3 dB (half power) beamwidth of 60 degrees. This antenna then provides 10.5 dBi gain in the direction in which it is aimed and 7.5 dBi (10.5–3) gain 30 degrees on either side of that direction. As you may have guessed, when gain or directivity increases, aiming the antenna becomes more critical.

Another concern with a satellite antenna is polarization. Radio waves consist of both electric and magnetic fields. Polarization refers to the way in which the electric wave varies in magnitude and direction at a given point in space. If the direction is constant and the magnitude is changing, we have linear polarization (LP) as with 2m FM (usually vertical) and 2m SSB (usually horizontal). If the magnitude is constant but the direction varies we have circular polarization (CP). Of course, there are two kinds of CP as well: clockwise rotation, called Right Hand Circular Polarization (RHCP), and counterclockwise rotation, called Left Hand Circular Polarization (LHCP). The circular polarization of these downlink signals is due to the satellite's own antenna polarization, the spinning of the satellite (spin modulation), and a phenomenon called Faraday Rotation. Because of these characteristics, AMSAT recommends an RHCP antenna for Mode B reception.

Two possibilities are the helix and the crossed yagi antennas. The helix may be the easiest to understand because its shape is circular (see Figure 2) like the impinging electric field. At 146 MHz a helix with 10 dBic is rather large (approximately 10 feet or 3 meters long and 26 inches or 0.67 meters in diameter). Also, helixes aren't readily available in the ham antenna marketplace. Homebrew is an alternative but the size won't change and the matching can be a challenge.

The second possibility, the crossed yagi, is sometimes called a "twist antenna." This antenna is a high-gain version of a turnstile or crossed dipole antenna. Simply stated, circular polarization is synthesized by feeding two dipoles (or driven elements) 90 degrees out of phase. Figure 3 illustrates two common phase-shifting methods. Crossed yagis are simply a pair of yagi antennas fed 90 degrees out of phase. They can be on two separate booms or on a common boom, as in Photo A. Some manufacturers now provide a switch so that you can select either RHCP or LHCP. This is a nice plus, but not a requirement. As you can imagine, a 146 MHz CP antenna with 10 dBi will have approximately 14 elements and have a boom length of 13 ft. (3.3 meters). When choosing the antenna, space and ability for satellite tracking must be considered. Photo A illustrates my 10-element crossed yagi with a counterbalance. Note that if a larger antenna is used, a nonconductive (like fiberglass) elevation boom should be used so as not to interfere with the performance of the antenna.

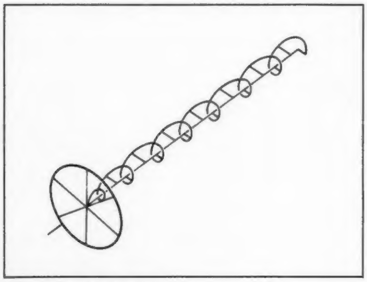


Figure 2. Helix antenna.

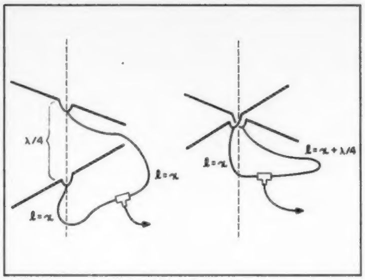


Figure 3. Two methods for achieving a 90-degree phase shift at the feed of an antenna to synthesize circular polarization. One method feeds both with the same phase but places the radiating elements ¼ wavelength apart. The other adds ¼ wavelength to the feedline to one of the elements.

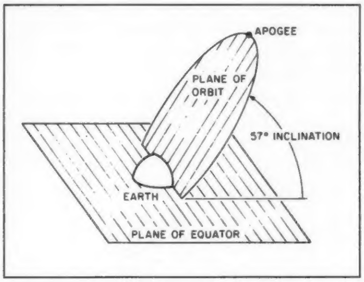


Figure 4. Elliptical orbit of Phase III C spacecraft, inclined 57 degrees.

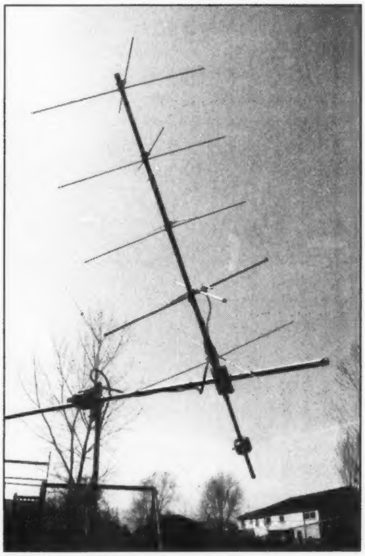


Photo A. 10-element crossed yagi antenna at ND9T. Note the counterbalance placed behind the antenna on an extended boom. This makes the job much easier for the elevation rotor.

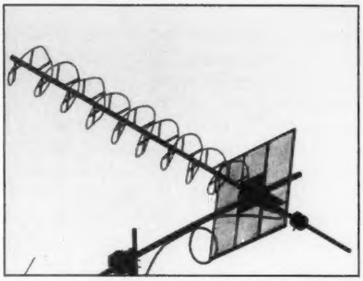


Photo B. Homebrew helix at ND9T. The 10 turns yield about 13 dB of gain. This antenna also uses a counterbalance.

The transmit link antenna for Mode B should be optimized for operation near 435.5 MHz. For Phase III satellites, AMSAT recommends an uplink (transmit) Effective Isotropic Radiated Power (EIRP) of 21.5 dBW. That means 21.5 dB gain referenced to a 1 watt isotropic source. This translates to a 10 watt xmtr (10 dBW) and a 14 dB gain antenna, allowing for 2 dB of loss in the transmission line. A 14 dB gain UHF (435.5 MHz) antenna is neither difficult to get nor difficult to steer.

As with the receive antenna, the transmit antenna should be circularly polarized, RHCP, and switchable if possible. The circularity can be achieved in the same manner as at 146 MHz. The same principles of directivity also apply. Higher gain can be achieved with greater directivity and a narrower beam width. This in turn requires greater antenna aiming accuracy.

At these frequencies it's easier to construct a helix like the one shown in Photo B. This is a home-brew helix like those described in many publications (e.g., *Satellite Experimenter's Handbook*). The helix shown in Photo B has a counterbalance positioned behind the antenna to make the elevation rotor's job much easier.

Positioning the Antenna

You'll need a certain degree of antenna aiming accuracy because of the line-of-sight nature of VHF and UHF propagation and the directivity of the antennas described above. Just as in terrestrial communications, azimuth positioning is required. Additionally, because the satellite's position can vary from horizon to directly overhead (see Figure 4), elevation positioning is very desirable.

With the highly elliptical nature of the Phase III orbits, and because of the beam width of these antennas, the sophistication of the antenna positioning system can vary from quite simple (non-motorized) to computeraided. The easiest method requires a general knowledge of the satellite's position (relative to the Earth station). The antenna can be simply elevated and azimuth-positioned. The position may not need to be adjusted for several hours if the satellite is near apogee.

At the other end of system complexity, AMSAT (and others) offer some very accurate satellite tracking programs for personal computers. With interface circuitry these computers can automatically position a satellite tracking antenna system. This becomes very advantageous when tracking the fast moving, low polar orbiters like the space shuttle.

Photo C shows a very common system. A standard azimuth rotor and a simple TV rotor are used for satellite tracking. When constructing the antenna system, it's important to keep metal objects (like the boom) outside of the antenna array. The design shown in Photo C accomplishes this by placing the boom behind the antenna, possible because of the counterbalance. With larger arrays, this would not be possible and a fiberglass boom should be used.

Receive Station

To repeat: The receive link is the most important component in a satellite Earth station. Figure 5 is a block diagram of a satellite receiving station. As I mentioned earlier, an RHCP antenna with approximately 10 dBic gain is recommended. There are three other very important components: the preamp, the transmission line, and the receiver.

The receive preamp is the single best thing that can happen to a satellite receive station. The inclusion of the low-noise preamplifier helps to find the very weak signals that have traveled 22,000 miles (36,000 km) from the satellite to Earth. The performance of such a device is measured by its noise figure (NF) and gain. Gallium arsenide field-effect transistor (GaAsFET) amplifiers with 0.5 dB NF and 10 to 20 dB of gain are readily available.

Photo D shows the home-brew version for 145 MHz that I use at my station. Good commercial units cost from $80 to $250. The preamp is most effective when placed right at the antenna. (I'll explain the reason for the location later in this article.) The next element in the receive link is the transmission line. At 145 MHz, coaxial cable can exhibit significant attenuation, or loss of that very weak signal energy. Table 3 illustrates typical transmission line loss at both 145 MHz and 435 MHz. Use the lowest loss cable that you can get. At 145 MHz I use Belden 9913 and at 435 MHz I use half-inch Heliax™.

The final element in the link is the receiver. The receiver should be capable of SSB and CW reception and tunable across the desired 145.9 MHz band in 10 Hz steps. Many manufacturers offer all-mode transceivers at 145 MHz whose performance is adequate. Another alternative is a receive converter. This device converts the receive frequency down to 50 MHz or 28 MHz where a suitable receiver can be connected.

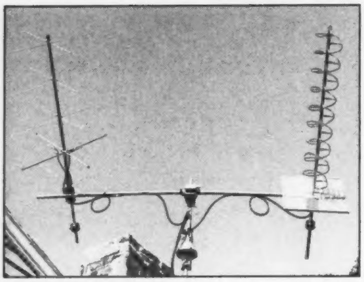


Photo C. Mode B antenna system at ND9T. Elevation rotor is a U-100 mounted on its side.

AMSAT recommends that the maximum effective noise temperature of the receive link be 625 degrees K, or a noise figure equal to 5.0 dB. The noise figure (NF) is a figure of merit. It is used as a measure of a receive system's ability to extract very weak signals (like satellite signals).

Table 3. Cable Type and Loss

Loss In dB/100 Ft.	Cable Type			
	RG-8X	RG-213	9913	½" Heliax
@150 MHz	3.5 dB	2.3 dB	1.5 dB	0.9 dB
@450 MHz	6.8 dB	5.2 dB	2.7 dB	1.5 dB

Earlier I mentioned noise figure, preamplifiers and transmission lines as being very important components of the receive link. The following example outlines the key role they play:

$NF = \text{Noise Figure} = 10 \log_{10} F$

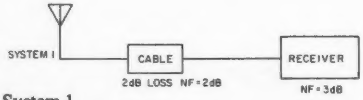
$F = \text{Numerical Ratio of NF} = 10^{\left(\frac{NF}{10}\right)}$, F not in dB

$G = \text{Numerical Gain, not in dB} = 10^{\left(\frac{Gain}{10}\right)}$

$\text{Gain} = 10 \log_{10} G$

$$Fs = \text{System Noise Factor} = F_1 + \frac{(F_2-1)}{G_1} + \frac{(F_3-1)}{G_1 \times G_2} + \ldots$$

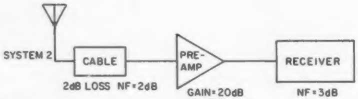
Element	Noise Factor (F)	Noise Figure (NF in dB)	G	Gain (in dB)
Coax	1.58	2 dB	0.63	−2 dB
Preamp	1.12	0.5 dB	100	20 dB
Receiver	2.00	3 dB	—	—



System 1

$Fs = 1.58 + \frac{(2-1)}{0.63} = 3.17$

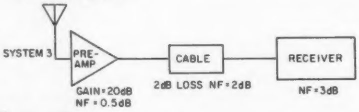
$NF = 5.01$ dB



System 2

$Fs = 1.58 + \frac{(1.12-1)}{0.63} + \frac{(2-1)}{(0.63 \times 100)} = 1.79$

$NF = 2.52$ dB



System 3

$Fs = 1.12 + (1.58-1)100 + \frac{(2-1)}{(100 \times 0.63)} = 1.14$

$NF = 0.58$ dB

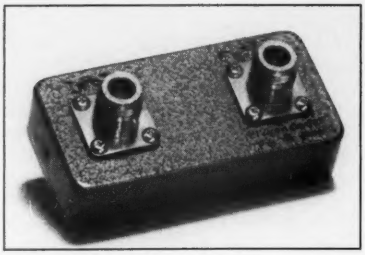


Photo D. Home-brew 145 MHz preamp at ND9T. This device has a measured gain of 24 dB and a noise figure of 0.43 dB.

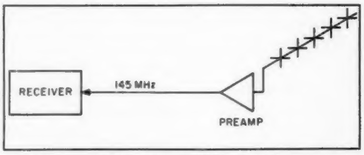


Figure 5. Receive link block diagram.

From the example it should be evident that the preamplifier can greatly improve the receive performance in weak signal reception. This example shows that a high gain, low-noise preamp placed at the antenna controls the receive link performance. Simply stated, a noise figure of 0.58 dB is better than a noise figure of 5 dB. But what does that mean to you as a listener? To better understand, let's look at the equation that relates the strength of the receive signal (Sr), the signal-to-noise ratio (SNR), the noise power of the receive system (No) and the noise figure (NF).

$Sr = NF + No + SNR$

The ratio of the output signal power to the noise power (SNR) is what we hear. 10 dB is a good number. The noise power in the system ($No = kTB$) can be considered a constant for our purposes. What we have to work with, then, are the receive signal power (Sr) and the noise figure (NF). If we can improve the NF from 5.01 dB to 0.58 dB, a 4.43 dB improvement, the input power can drop by 4.43 dB and the SNR will not change. That means that the receive signal could drop by a factor of almost three ($2.77 = 10^{.443}$) and the operator would not notice any difference in the signal quality. So, both inclusion of a preamp (preferably at the antenna) and use of low loss cable is quite important in a satellite receive link.

Transmit Station

Once the receive link is complete the next major hurdle is the transmitter. The Mode B uplink signals are in the 435.425 MHz to

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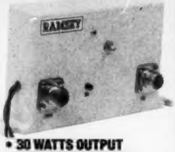

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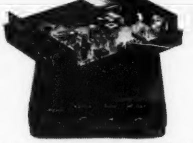
New low cost microwave doppler radar kit "clocks" cars, planes, boats, horses, bikes, baseballs, models, runners or virtually anything that moves. Operates at 2.6 GHz with over 1/4 mile range. LED digital readout displays speeds in miles per hour, kilometers per hour or feet per second! Earphone output permits listening to actual doppler shift. Uses two 1 lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. Kit includes deluxe ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

RADIOS



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Sensitive all mode, AM, CW, SSB receivers for 3.5—4.0 or 7.0—7.5 MHz. Direct conversion design using NE602 IC as featured in QST and ARRL handbooks. Less than 1 μv sensitivity, varactor diode tuned, 50 mw audio output. Runs on 9VDC, has RF gain control. This kit is very easy to build, lots of fun and educational—ideal for the beginner or the old pro. The optional matching case kit features a rugged ABS plastic case with screened graphics. Included are machined aluminum knobs for a well-finished professional look.

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Operate a mini ham shack. These little CW rigs are ideal mates to our 40 and 80 meter receivers. Features include smooth variable tuning, one watt output and excellent keying characteristics. Runs on 12 VDC and is VSWR protected. See how far you can stretch your signal with one of these mini rigs. Optional ABS cases are available.

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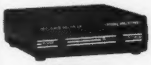

PS-2 AUDIO MULTIPLIER

The PS-2 is handy for high resolution audio resolution measurements, multiples Up in frequency • great for PL tone measurements • multiples by 10 or 100 • 0.01 Hz resolution & built-in signal preamp/conditioner

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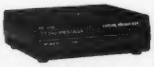

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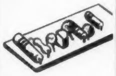

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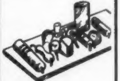

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For built-in applications or hobby experimentation. Full fledged superhetrodyne receiver, microvolt sensitivity, 10.7 MHz IF, Integrated Circuit detector, 50 mw audio amplifier, 9V external power source, operation on standard FM broadcast band as well as large portions on each side, compact (6" square), for bug detection or reception
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A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.
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A real microwave doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz and is not affected by heat, light or vibrations. Drives up to 100 ma output, normally open or closed, runs on 12 VDC.
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Communicate in total privacy over your telephone or radio. This scrambler kit features full duplex operation using frequency inversion. Runs on a 9 volt battery. Both mike and line or speaker output/inputs. Easy to connect to any radio—telephone use requires no direct connection! Easy to build, uses IC DBM circuitry . Can also be used to descramble most com. scramblers.
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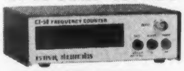
CT-50 8 DIGIT 600 MHz



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Telescopic whip antenna—BNC plug	$ 8.95
High impedance probe, light loading	16.95
Low pass probe, audio use	16.95
Direct probe, general purpose use	13.95
Tilt bail for CT-70, 90 & 125	3.95
Nicad pack for CT-70, 90 & 125	8.95

MODEL	FREQ RANGE	SENSITIVITY	ACCURACY	DIGITS	RESOLUTION	PRICE
CT-70	20 Hz-550 MHz	< 50 mv To 150 MHz	1 PPM	7	1 Hz, 10Hz, 100Hz	139.95
CT-90	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 Mhz	1 PPM	9	0.1Hz, 10Hz, 100 Hz	169.95
CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1Hz, 10Hz	189.95
CT-125	10 Hz-1.25 GHz	< 25mv @ 50 MHz < 15mv @ 500 MHz < 100mv @ 800 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	189.95
CT-90 WITH OV-1 OPTION	10 Hz-600 MHz	< 10mv To 150 MHz < 150mv To 600 MHz	0.1 PPM	9	0.1Hz, 1Hz, 10Hz	229.90

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435.575 MHz band (OSCAR 13). AMSAT recommends an uplink signal EIRP of 21.5 dBW. This equates to a 20 W transmitter, 2 dB loss in cable and an 11 dBic gain antenna (13 dBW − 2 dB + 11 dB = 22 dBW). If you choose an 11 dBic antenna and very low loss transmission cable (like Heliax), you can get the desired EIRP with a 20 W transmitter.

As with the 145 MHz receiver, there are many commercially available UHF transmitters. They should be capable of SSB and CW transmission with from 10 W to 100 W output. An alternate method of signal generation is a transverter. This device converts a modulated (SSB or CW) low frequency signal to the desired UHF band. Photo E shows such a device in use at my station. An all-mode transceiver (IC-740) generates the SSB signal at 28 MHz. A low power (100 mW) output is provided on the back of the transceiver that drives the transverter. This device (Microwave Modules MM435-28S) up-converts the low level signal to 435 MHz and amplifies it, providing a 10 W output. You can also use a power amplifier to augment a low power transmitter, if that's what you want or need. Figure 6 shows a block diagram of my transmit station.

The output power from the satellite is divided among all the using stations. AMSAT and all conscientious satellite users recommend using as little transmit power as possible to maintain the communication link. While monitoring your downlink signal, adjust the uplink power level so that it is no stronger than the satellite's beacon transmitter.

Locating the Satellite

A crucial part of successful satellite communication is locating the satellite. The more directive (higher gain) the antenna, the more critical the aiming. A typical TVRO dish antenna (receiving a 4 GHz signal) needs to be within a degree or so of the proper aiming angle, elevation and azimuth. The typical 10 dBic Phase III (AO-13) antenna will have a half-power beamwidth (−3 dB) of 60 degrees. Aiming this type of antenna is far less critical.

An elevation/azimuth tracking antenna system is best for Phase III reception. This system can be manual because of the relatively slow movement of a satellite at the apogee of a highly elliptical orbit. Low orbiting satellites, like the Russian satellites or the space shuttle or the new MicroSATS, usually require a motorized system.

Where is the satellite? OSCAR 13 will go as high as 22,000 miles (36,000 km) above the Earth in an orbital plan inclined at 57 degrees. (See Figure 4.) The easiest method for satellite location is a tracking program for a personal computer. These are readily available from AMSAT for quite a variety of computers. Given the user's station location and updated information on the satellite's orbit, called orbital elements, these programs compute the aiming angle for the antenna at any given time. Some even show a map of the Earth with the satellite's path plotted. In the event that computers aren't available, you can tune your receiver to the satellite's beacon signal, elevate the antenna to 45 degrees, and sweep the south looking for the strongest signal.

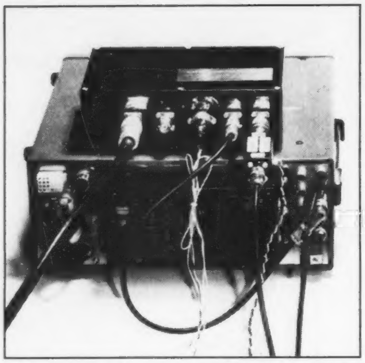

Photo E. Microwave Modules UHF transverter and HF radio used at ND9T. Most modern day transceivers are readily interconnected to a transverter.

Another (older) method is to use an OSCARLOCATOR. This is a graphical plotter available from AMSAT and the ARRL.

> **"The easiest method for satellite location is a tracking program for a personal computer."**

Operating a Mode B Station

Once the antennas are aimed, and the station is on the air, the next step is operation. AMSAT regularly publishes information on the satellite's operating schedules. The schedule depends on the satellite's position (sun angle, antenna angle, etc.), battery voltage and many other parameters monitored by AMSAT. When these conditions are favorable and the transponder of interest is in operation, you can begin your search for the satellite signals.

First, find the beacon signal (145.810 MHz for AO-10, 145.812 MHz for AO-13). Set the uplink transmitter to the desired frequency and the downlink to the expected receive frequency. (See Tables 1 and 2.) Note that the uplink/downlink signals are inverted (LSB becomes USB) by the satellite. Begin by transmitting a string of dots (CW) and vary the receive frequency until you can hear the downlink. It can be delayed by almost a quarter of a second because of the extreme distance the signal must travel. Listening to the uplink and delayed downlink can be quite distracting!

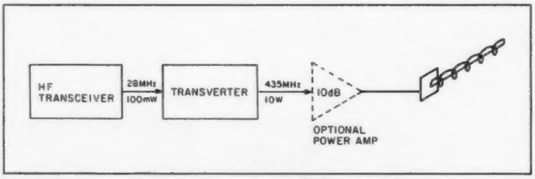

Figure 6. Transmit link block diagram.

Once you locate the signal, you can switch to SSB or continue CW. Because of the time delay I do not continuously monitor the downlink signal once it has been located. The signal may vary in frequency by a few kilohertz because the movement of the satellite causes a Doppler shift in frequency. Because of the tumbling of the satellite, signal rotation and atmospheric conditions there may cause amplitude variations in the signals. Once the operator becomes accustomed to these phenomena, QSOs become routine. Conversation can vary from a few moments to a few hours with these satellites. Chances are you will discuss how your new acquaintance went about building his or her Mode B station. Satellite QSOs are lots of fun!

Where to Get More Info

This article presents the basics of a Mode B Earth station for Phase III satellite communications. Topics on antennas, receive and transmit links, satellite locating and operating have been covered to give you some idea as to how to assemble a Mode B station. If you need more information, use the references provided below. AMSAT satellite information updates are also given regularly on W1AW and on the AMSAT Tuesday evening net (2100 local) at 3.842 MHz and on Sunday afternoon (1900 GMT) at 14.282 MHz. You can also write AMSAT at PO Box 27, Washington, D.C. 20044 or call at (301) 589-6062. Hope to see you on OSCAR soon!

References:
Davidoff, Martin R., *The Satellite Experimenter's Handbook*, ARRL.
The ARRL Antenna Book, ARRL.
The ARRL Handbook, ARRL.
AMSAT, Box 27, Washington D.C. 20044.
ARRL, 225 Main Street, Newington CT 06111.

Timothy R. Kearney ND9T was first licensed in 1966 (at age 14). He has a bachelor's degree from Notre Dame University and a master's degree from Purdue University, both in electrical enginering. He has taught at Purdue, worked at Scientific Atlanta where he co-authored a book entitled Introduction to Satellite TV. *ND9T currently manages a development group at Magnavox. He has been an AMSAT member since 1972 and has served as an Area Coordinator in Georgia and currently in Indiana. Contact him at 6421 Wayoata Court, Fort Wayne IN 46815.*

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FL-52A 500 Hz CW filter (2nd IF)....	115.00	**109^{95}**
FL-53A 250 Hz CW filter (2nd IF)....	115.00	**109^{95}**
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PS-30 Systems p/s w/cord, 6-pin plug	349.00	**319^{95}**
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CK-70 (EX-299) 12V DC option......	12.99	
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R-7000 25MHz-2GHz rcvr..... ***(Special)***	1199.00	**999^{95}**
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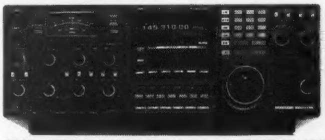
EX-310 Voice synthesizer.............	59.00	
TV-R7000 ATV unit.....................	139.00	**129^{95}**
AH-7000 Radiating antenna..........	99.00	



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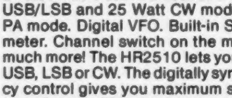

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73 Book Review

by Larry R. Antonuk WB9RRT

Elements of Microwave Electronics Technology

A microwave text for hams at all levels.

Elements of Microwave Electronics Technology
by Joseph J. Carr, Copyright 1989
Harcourt Brace Jovanovich, Inc.
1250 Sixth Avenue
San Diego CA 92101
Hardcover Price: $31.00

Does microwave electronics look to you like a confusing mixture of feed horns, dish antennas, plumbing fixtures and voodoo? Or, are you one of the brave souls who just plunged into microwave communications and found it to be an exciting segment of ham radio activity?

Whatever your level of experience, there comes a time when a little education can go a long way. A timid beginner needs to know a few of the pitfalls before he starts; a seasoned experimenter may want to round out his practical experience with some theory. The choice of the proper book can make or break a learning experience.

Between "Too General" and "Too Specific"

For the most part, existing material on microwave electronics falls into one of two categories. You can often find information in a short chapter at the back of communications books. This is usually much too general in nature. You can also find books dedicated to microwave electronics. These books target too specific a subject area, or they require an MSEE to get beyond the preface.

The answer to this dilemma has just been published. Written by Joe Carr, a friendly name to readers of electronics books, the *Elements of Microwave Electronics Technology* is a complete discussion of microwave communications technology. This manual takes the reader from a history of microwave development through transmission lines, wave guides, filters, antennas, and the use of the Smith Chart. A history of early microwave RF power generators leads into several chapters on microwave active devices—tubes, transistors, diodes, hybrid and monolithic ICs, and the uses of these devices in amplifier circuits. It also covers transmitters and receivers, and wraps up with a discussion on radar systems and communications systems.

The best thing about *Elements of Microwave Electronics Technology* is that it's a textbook. While this might bring back unpleasant memories for some readers, it really means that we're talking about a quality book. The graphics are top-notch. The text is readable, and broken into easily digestible sections. Each section begins with the chapter objectives and a pre-quiz. After each chapter there's a summary and recapitulation, followed by questions and problems (the ol' tell-'em-what-you'll-tell-'em/tell-'em/tell-'em-what-you-told-'em method). In short, a solid method to learn whatever it is that you need to know about microwave electronics.

Home-brew hams should be forewarned that, because it is a textbook, this book deals with practical problems and solutions and totally avoids the nuts-and-bolts side of things. There are no "Build a 24 GHz Transmitter from a Radar Detector and a Soup Can" chapters here. But for the home-brewer who needs to know a little more precisely why things work, or just for the curious beginner, *Elements of Microwave Electronics Technology* is a wise investment.

Larry Antonuk WB9RRT has written numerous reviews on test equipment and electronics books. He currently works as a project manager for a land mobile service shop in Keene, New Hampshire. He enjoys home-brew projects, experimentation, and instrumentation. Contact him at P.O. Box 452, Marlborough NH 03455.

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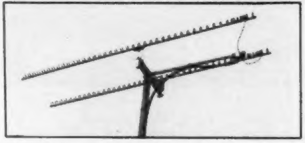

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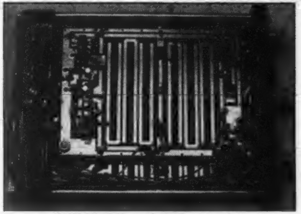

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SHF 2401K	2400 MHz Mode S rcv Conv		Kit $150	Built $250
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73 Review

by Bill Clarke WA4BLC

Master of CW

The MFJ-486 Grandmaster Memory Keyer

MFJ Enterprises, Inc.
P.O. Box 494
Mississippi State MS 39762
Phone: (800) 647-1800
Price Class: $190;
MFJ-1312 AC adapter, $13;
MFJ-77 Remote Control Keypad, $20.

By now everyone is pretty familiar with automatic keyers. They are the little electronic devices that allow us to send nearly perfect CW with a minimum of effort using a paddle (straight or iambic) as a key. Most keyers offer some variable controls for customizing dit and/or dah weight, and a few offer various memory schemes. Memories provide a means of recording repetitious messages (CQs, QTH, station info, UR RST IS, etc.) for later transmission, usually at the push of a single button.

The MFJ-486 Grandmaster Memory Keyer does all of the above, then enters the next dimension of automatic keyers—the MFJ CW Word Processor™. CW word processing is as close to having a computerized CW station as you can get without actually having a computer (and all that goes with it: large size, display, keyboard, RF noise, etc.). The Grandmaster is only 9"W x 2.5"H x 6"D and weighs less than a pound.

Features

Before getting into the complexities of the Grandmaster let's look at some of its features:

- Works with grid block, cathode, and direct keying.
- Headphone jack for private listening.
- Has provisions for external control (MFJ-77 Remote Control Keypad).
- Adjustable speed from 4–100 wpm.
- Adjustable weight.
- Variable tone and volume.
- 10 message memories.
- Automatic contest number generation.
- Random code generator.

MFJ has placed a warning at the top of the first page of the operating instructions. It states, "PLEASE READ THIS ENTIRE MANUAL BEFORE OPERATING THIS EQUIPMENT!" This is no idle warning, since without a complete understanding of all the controls and features on the Grandmaster, you will be unable to make it work to its fullest capabilities.

The manual is not fancy, being only copies of typewritten text. However, it is effective in getting the necessary information across to the reader.

Message Memories

The 10 message memories provide a total of 8000 character spaces. To illustrate the total size of this memory: A full column of 73 text (from the top of the page to the bottom) contains about 3500 characters. The memories are soft partitioned, meaning they are not of fixed size, and have a lithium battery backup.

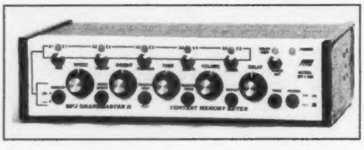

Photo A. MFJ-486 Grandmaster Memory Keyer (courtesy of MFJ). A complete neophyte can master code and become a formidable contester with this device.

You can use either straight or iambic paddles with the Grandmaster. The sending speed is adjustable from a front panel potentiometer with a programmable speed range. The latter functions similar to "band spread" or slow tuning by setting the top and bottom speeds of the desired range on a 1:5 basis. For example, the slowest range is 4–20 wpm and the fastest is 20–100 wpm.

> *". . . the quick operation of the memories and placement of the incremental serial number will no doubt raise scores and make contesting easier and less rushed."*

CW Word Processing

Have you ever entered a lengthy message into your keyer's memory, only to mess something up at the very end? Or, do you have a canned message that is no longer up-to-date due to an equipment or antenna change? With the MFJ CW Word Processor you can insert, delete, and otherwise edit your messages in very much the same way that a typist does on a word processor.

Memory editing is done one "word" at a time. As each word in the memory is sent out for edit, you can either change or delete it, insert additional text, or accept it and have the next word sent.

My Use of the Grandmaster

Memory messages can include automatically incremented serial numbering for contests, repeat messages (CQs and beaconing), and normal memory messages like callsigns, QTH, station info, etc. With the large amount of memory available in the Grandmaster, I felt like a piker for using such a small amount for my test messages.

The memories are in two banks, A and E. I set up my memory messages as follows:

A1–CQ CQ CQ DE WA4BLC CQ CQ CQ DE WA4BLC CQ CQ CQ DE WA4BLC K
A2–DE WA4BLC K
A3–TNX FOR CALL. NAME & QTH. UR RST IS (you hand-send this)
A4–STATION, EQUIPMENT, AND ANTENNA INFORMATION
A5–stores the current E5 for resending in E3
E1–CQ SS CQ SS DE WA4BLC
E2–NR (add in memory E5) A WA4BLC 68 VA K
E3–NR (add in memory A5) A WA4BLC 68 VA K
E4–QSL UR NR (hand key this)
E5–automatically increments numbers that are called in E2

As you can see, I have set each bank for a specific use, one for normal contacts and the other for sweepstakes. They can be customized in any fashion for nearly any use. The one limitation on memory usage is A5 and E5 which are reserved to hold only four digit numbers, the latter incrementing after each use.

Memories may be embedded into one another, as I did in E2 and E3. E2 calls the next incremental number from memory E5 to be sent. E3 is used in case the message needs to be resent and will not cause the number to increment.

Of course, this could all be changed. For example, one message could hold signal reports: UR RPT IS (hand key this) or you could put in UR RPT IS 599. (All signals are 599, aren't they?)

For the contest operator, the quick operation of the memories and placement of the incremental serial number will no doubt raise scores and make contesting easier and less rushed. Use of the Remote Control Keypad makes contacts go even quicker by placing the memory controls in your hand.

Although you can make a normal contact easier by using the memories for canned information (QTH, name, station info, etc.), I wonder if something is lost in the quintessence of the contact. I often feel we have progressed to the point where personality is being removed from our contacts. This is one reason I am not active on packet. Oh well, I guess I'm just old-fashioned.

Code Course

Did anyone notice that last entry on the list of features? It refers to the random code generator, which is a complete three-step CW course. This means a neophyte could purchase the Grandmaster, use it to master the code, then go on to be a contest champion, all with the same device.

The MFJ-486's code course comes in three logically designed steps. The first teaches letters and punctuation by sending random characters in groups of five.

The second step sends mixed random characters in assorted groups up to eight characters long.

The last step of the code course is an infinite number of random QSOs sent in the same general format as you will find on VE exams.

The Farnsworth method is included as an option, along with answer-replay features for checking the accuracy of your copy.

For the student of CW, working to master Mr. Morse's curse, the Grandmaster's built-in CW course is perfect, particularly the practice QSOs.

Room for Improvement

The Grandmaster is a very sophisticated—that is, complicated—device. To get the most from it, you have to use it constantly to stay in practice with all its capabilities.

The MFJ-77 Remote Control Keypad is too light, and slides around on the desk. Additionally, the control's cable is too stiff, compounding the keypad's resistance to staying put.

There is no specific means for speed control when using the code course option. The student is left to his own devices. I do note, however, that one way of setting the default to 20 wpm is to turn the speed control fully counter clockwise and press the SPEED SET switch. Set in this manner, the slowest speed in the range is 4 wpm. Using the 5:1 ratio of the speed control, the fastest would be 20 wpm.

In the Future

I cannot help but wonder if there is a Grandmaster Memory Voicer in the works. Such a device would use digitized voice memory for messages, with features otherwise similar to the CW keyer.

Warranty

The Grandmaster comes with MFJ's *One Full Year No Matter What*™ guarantee. This means MFJ will fix your Grandmaster for one year no matter what happens to it. This is the kind of service customers want; other manufacturers should take note.

The MFJ-486 Grandmaster Memory Keyer is available from many amateur dealers around the world, as well as from MFJ Enterprises, Inc., at the above address. ■

Bill Clarke WA4BLC, research and aviation writer, has written many reviews for 73. You may reach him at PO Box 2403, Falls Church VA 22042-0403.

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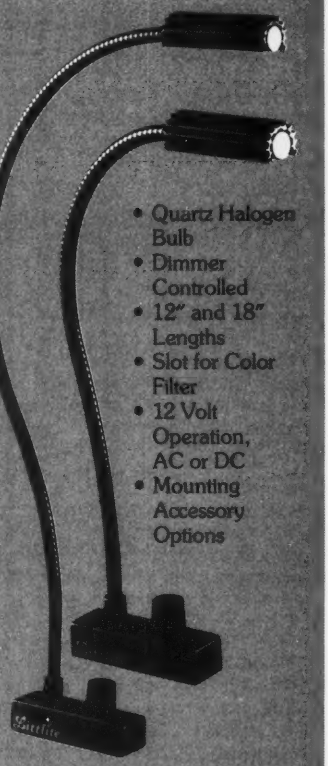

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73 Review

by Dave Buren N2GE

Command Technologies ‘‘Commander’’ HF-2500

A ’90s generation linear amplifier!

Command Technologies, Inc.
1117 West High Street
PO Box 939
Bryan OH 43506
(800) 736–0443
Price Class: $2200

We’re in the space age—high-tech supermolypermaloy this and avalanche-clamped high dv/dt MOSFET that. Hypersil shrunk the transformer; Eimac shrunk the “jug.” Electrolytic capacitor technology, utilizing micro-etching and polysyllabic electrolytes, has decreased size to the point where you can hold a farad of capacitance in one hand. The days of the seven-foot-high rack amplifier with link-coupled output, mercury vapor rectifiers, and multiple 813s are gone for good. Swinging chokes, bigger than most plate transformers today, and banks of can capacitors with porcelain-insulated terminals are but a memory. The stage has been set for the ’90s generation of linears.

The latest desktop entry, Command Technologies’ Commander HF-2500, uses a pair of 3CX800A7s and fits squarely alongside the Titan and the Alpha in power and size. It operates class AB2 and achieves 1500 watts output without much effort.

The First Encounter

If you’re like I am, the first thing you do with a new piece of equipment is open’er up, take a whiff of the new electronics smell, and check out the hardware. These are some of the most exciting few minutes of new ownership.

Just take the HF-2500 out of its carton, place it on the bench, and it’s ready to go! The tubes and the transformer are factory-installed. It’s 220 VAC only—just add a power plug to mate your particular installation. Like black body cameras and 200 watt stereo amps, this unit was all black, with red trim and lettering and a white illuminated single meter. Not a bad first impression.

The Commander has a special hex socket type of flat head screw called a button-head. It’s almost as if the manufacturer wishes you wouldn’t open it up. But, if you want to convert the Commander to 10 and 12 meters, you gotta.

I popped open the lid and shone a good bench light down into the top. The first thing to catch my eye was the tank circuit and bandswitch. All the contacts are “coin silver” plated, and the switch is super heavy duty. The feel of changing bands and the resounding clack of the detent attest to this! The tank coil also has a thick silver plate, as do all of the interconnecting tap straps and parasitic suppressors.

Something was different here, though! Buried down under the plate tuning cap was a huge ferrite toroid with taps. This is the 160–80–40 meter portion of the pi-output. A design Q of 14 with the toroid does an amazing shrink job of the pi-output. The size is further reduced by matching from plate load impedance of 1400 ohms down to 200 ohms and then utilizing a 4:1 reactance-tuned ferrite to get the rest of the way down to 50 ohms. As long as you avoid saturation this sure makes for a tight, compact box. Judging from the size of the toroids, saturation is not a problem. The plate transformer weighs 35 lbs. and accounts for half the total weight of the unit. It has a continuous commercial service rating of 1.6 amps. But wait a minute . . . where are the filter caps and diodes?

The answer to this question wasn’t immediately apparent. A check of the schematic indicated a conventional full-wave voltage doubler circuit delivering 2650 VDC. The caps are 220 uF, 450V jobs in doubler series for an effective 27.5 uF. So, back to the visual inspection. Tracing the secondary HV wires from the transformer, I discovered that the caps and the diodes reside in the airstream inside the pressurized containment underneath the tube sockets. That’s good news for the caps because heat is the worst enemy of electrolytics. Pressurized cooling is delivered by a 50 C.F.M. Dayton squirrel-cage blower which is located on the cool side of the chassis.

Band Coverage

All the HF bands, 160 through 10 meters, worked successfully. Tune-up was quick and simple: the normal iterative tune, load, drive adjust and plate current dip while observing the wattmeter for maximum output. The 3cx800’s require only 50 to 80 watts nominal drive to reach full legal power. This is sure a change for me—not having the power level pot cranked all the way clockwise.

When you reach the 1500 watt output level adjust the load control for 90 mA of grid current or less. The 3-position multimeter covers plate voltage and current and grid current.

Once tuned up, I found that I tended to leave the meter in the IG position. It’s a snappy meter movement and gives a good indication of instantaneous peak current. The 12 meter band is loaded with the bandswitch in the 10m band position, 17m in the 15m position, and 30m in the 40m position. WARC positions on the bandswitch would have been nice here. The problem lies in the tuned input because there seems to be plenty of range in the pi-output. The manufacturer admits that the unit will operate on the WARC bands at reduced power, or at full power “with an easy adjustment to the tuned input circuitry,” implying that you will now operate at reduced power on the corresponding non-WARC band. There might be a compromise position for both bands but I sidestepped the problem entirely by adding a Johnson Matchbox between my solid-state rig and the linear input. This is something I got into the habit of doing with my home-brew 4 x 1, which doesn’t have tuned input or bandswitch—just a big roller inductor.

COMMANDER HF-2500

Photo A. The Commander HF-2500 front . . .
Photo B. . . . and rear.

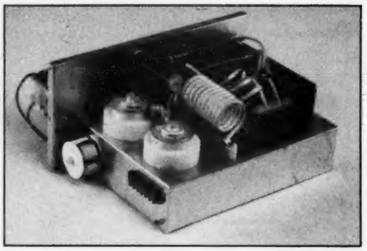
Incidentally, I wish I could tell you how easy and convenient the conversion to 10 meters really is. If you supply a copy of your license, Command Technologies will give you instructions to activate 10 and 12 meters.

The HF-2500 uses an adjustable L-C-L (T-Match) tuned input network for each of the non-WARC amateur bands. A slot screwdriver or tuning stick adjustment from the rear panel will let the solid-state rig look into a clean 1:1 VSWR. There is also an adjustment for the ALC.

Operating

I don’t need to expound upon the assets of an extra 10 or 12 dB of gain into a good antenna system. I found the HF-2500 to be responsive and clean. Reports all verified that the signal was splatter-free and clean, including Fr. Moran 9N1MM who came back on my first call.

Dave Buren N2GE is a Principal Electrical Engineer at Markem Corp. in Keene, New Hampshire. He specializes in hardware design and motion control. He has a B.S in math and a B.S.E.E. Dave also works as a station engineer at a commercial FM radio station in Peterborough, New Hampshire. He has been a ham since 1954, and could care less how many countries he’s worked toward DXCC. He also enjoys mountain climbing. You can reach him at 357 Middle Hancock Rd., Peterborough NH 03458.



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Build The Banker

A convenient memory bank selector for the TS-940S.

by Michael Jay Geier KB1UM

The TS-940S is one of the finest HF rigs available today, but it has one major deficiency: the location of the memory bank selection switch. There are four banks of ten memories (for a total of 40) but the bank selection switch is located under a cover on top of the radio, along with some seldom-used controls like the VOX gain. It's an inconvenient location so most of us just use one bank and ignore the rest.

This project shows you how to build a simple circuit that can be installed in place of the optional voice synthesizer board—you won't need to modify the radio. The completed project will allow you to select memory banks using the VOICE button on the front panel.

About the Circuit

The bank switch in the '940 operates in an "active low" binary sequence: It is wired to short to ground two lines coming from the radio's digital control system. The sequence is:

Bank 4: HH
Bank 3: HL
Bank 2: LH
Bank 4: LL

Thus, when the switch is set to Bank 4, it is an open circuit and effectively disappears.

The bank selector circuit intercepts the command generated when you press the VOICE button and increments a 2-bit binary counter, generating logic 0s (zero volts or "L") in the same sequence as the switch. After passing through the diodes, which prevents logic 1s (5 volts) from damaging other circuits, the signals are coupled in parallel with the switch through the four-pin connector on the right side of switch unit F (the black

Parts List

Device	Value/Type	Available At:
IC1	4001B	Jameco, Digi-Key, Radio Shack (Catalog #276-2401)
IC2	4027B	Jameco, Digi-Key
R1	100K	
R2	470K	
C1	1µF	
C2	0.1µF	
D1	1N914 type	
D2	1N914 type	

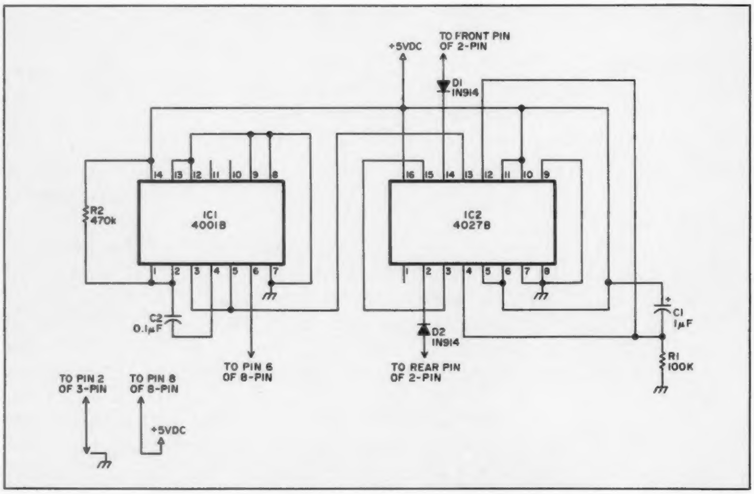

Figure 1. Schematic diagram for "The Banker." Power supply: 5VDC, supplied by TS-940S. Circuit type: CMOS, sequential switching. Input: Voice synth. start signal from TS-940S. Outputs: Active low to ground, binary coded. Backup power: None.

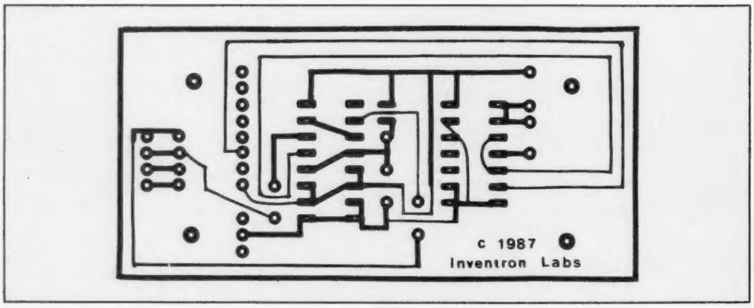

Figure 2. Foil pattern.

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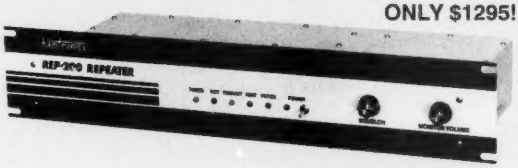

- Available for the 10M, 6M, 2M, 220MHz, 440MHz, 902MHz ham bands. ***FCC type accepted** models also available for vhf and uhf commercial bands.*
- **Rugged exciter and PA**, designed for continuous duty.
- Power output 15-18W (25W option) on 2M or hi-band; 15W on 220MHz; 10W on uhf or 902MHz.
- Accessory add-on PA's available with **power levels up to 100W.**
- **Five courtesy beep types**, including a pleasant multi-tone sequence.
- **AUTOPATCH**: either **open or closed** access, **toll-call restrict**, auto-disconnect.
- **Reverse Autopatch**, two types: auto-answer or ring tone on the air.
- **DTMF CONTROL**: over 45 functions can be controlled by touch-tone. Separate 4-digit control code for each function, plus extra **4-digit owner password.**
- **Owner can inhibit** autopatch or repeater, enable either open- or closed-access for repeater or autopatch, and enable toll calls, reverse patch, kerchunk filter, site alarm, aux rcvr, and other options, including two auxiliary external circuits.
- The cwid message, dtmf command codes, and owner-specified default parameters for cor and cwid timers and tones are burned into the eprom at the factory.
- Cw speed and tone, courtesy beep and tail timers, and courtesy beep type **can all be changed at any time** by owner-password-protected dtmf commands.
- Many **built-in diagnostic** & testing functions using microprocessor.
- Color coded led's **indicate status** of all major functions.
- **Welded partitions** for exciter, pa, receiver, and controller. PEM nuts for covers.
- 3-1/2 inch aluminum rack panel, finished in eggshell white and black.
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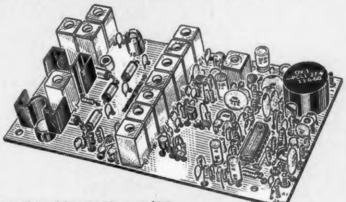

FM EXCITERS: kits $99, w/t $169. 2W continuous duty. TCXO & xtal oven options available. *FCC type accepted for com'l uhf & hi bands.*

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- **TA451** for uhf.
- **TA901** for 902-928MHz, 0.5W out (w/t only, $169).
- **VHF & UHF AMPLIFIERS.** For fm, ssb, atv. Output from 10W to 100W. Several models, kits starting at $79.

FM RECEIVERS: kits $139, w/t $189.

- **R144/R220 FM RECEIVERS** for 2M, 150-174, or 220MHz. **GaAs FET** front end, 0.15uV sensitivity! Both crystal & ceramic if filters plus **helical resonator** front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere!) Flutter-proof hysteresis squelch; afc tracks drift.
- **R451 UHF FM RCVR**, similar to above
- **R901 902-928MHz FM RCVR.** Triple-conversion, GaAs FET front end.
- **R76 ECONOMY FM RCVR** for 10M, 6M, 2M, 220MHz, w/o helical res. or afc. Kits $129.
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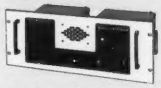

If you prefer a plain-vanilla or kit repeater, you couldn't find a better value than our original

REP-100 REPEATER

Same fine rf modules as REP-200 but with COR-4 Controller. Can add autopatch, dtmf decoder, CTCSS, either now or later. **Kit only $675, w/t $975.**

ACCESSORIES

COR-3 REPEATER CONTROLLER kit. Features adjustable tail & time-out timers, solid-state relay, courtesy beep, and local speaker amplifier $49

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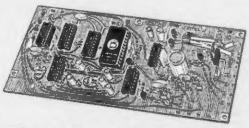
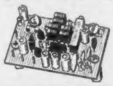
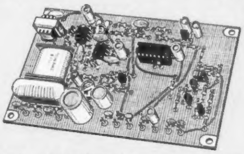


NEW COR-4 kit. Complete COR and CWID all on one board for easy construction. CMOS logic for low power consumption. Many new features. EPROM programmed; specify call .. $99



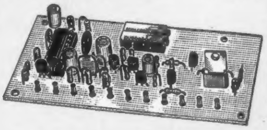
NEW TD-3 SUBAUDIBLE TONE DECODER/ENCODER kit. Adjustable for any tone. Designed **especially for repeaters,** with remote control activate/deactivate provisions $24

TD-2 TOUCH-TONE DECODER/CONTROLLER kit. Full 16 digits, with toll-call restrictor, programmable. Can turn 5 functions on/off. Great for selective calling, too! $79



AP-3 AUTOPATCH kit. Use with above for repeater autopatch. Reverse patch & phone line remote control are std . $79

AP-2 SIMPLEX AUTOPATCH Timing Board kit. Use with above for simplex operation using a transceiver $39



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- **High gain:** 13-20dB, depends on freq
- **Wide dynamic range** - resist overload
- **Stable:** low-feedback dual-gate FET

**Specify tuning range: 26-30, 46-56, 137-150, 150-172, 210-230, 400-470, or 800-960 MHz.*

LNW-(*)

MINIATURE GaAs FET PREAMP

***ONLY $24**/kit,* **$39** wired/tested

- GaAs FET Preamp similar to LNG, except designed for **low cost & small size.** Only 5/8"W x 1-5/8"L x 3/4"H. Easily mounts in many radios.

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LNS-(*)

IN-LINE PREAMP

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- GaAs FET Preamp with features similar to LNG series, except **automatically switches out of line during transmit.** Use with base or mobile transceivers up to 25W. Tower mounting brackets incl.

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Preamps with 3 or 4 section helical resonators **reduce intermod & cross-band interference** in critical applications. **MODEL HRA-(*)**, $49 vhf, $94 uhf.

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VHF input ranges avail: 136-138, 144-146, 145-147, 146-148, 220-222, 222-224; kit less case $39, kit w/case $59, w/t in case $89.

UHF input ranges avail: 432-434, 435-437; kit less case $49, kit w/case $69, w/t in case $99.

902-928 MHz converts down to 422-448 or 430-450 range. Same price as uhf.

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CIRCLE 57 ON READER SERVICE CARD

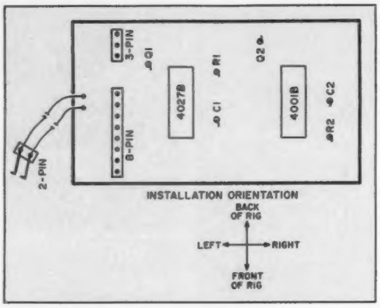

Figure 3. Installation orientation.

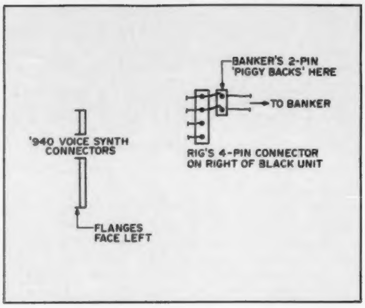
BANKER'S 2-PIN 'PIGGY BACKS' HERE
TO BANKER
'940 VOICE SYNTH CONNECTORS
RIG'S 4-PIN CONNECTOR ON RIGHT OF BLACK UNIT
FLANGES FACE LEFT

Figure 4. Flanges face left.

unit containing the bank switch). As long as the switch remains in Bank 4, the selector can pull the appropriate lines low and step through the banks.

The signals intended for the voice synthesizer are narrow and rapid, and vary depending upon the frequency to be spoken. They occur in a burst each time you press the VOICE button so some input signal conditioning is required to prevent false or unreliable triggering of the selector circuit.

In the schematic diagram in Figure 1 IC1, a 4001B quad NOR gate operates as a monostable multivibrator, or "one shot". The first pulse, applied to pin 6, fires the one-shot (with R2 and C2 providing the time constant) that remains triggered for the duration of the burst. The result is a single pulse of several milliseconds, suitable for triggering IC2.

IC2 is a 4027B dual JK flip-flop, used as a 2-bit binary counter. C1 and R1 provide a reset pulse when the rig is first turned on, setting the flip-flop's two NOT-Q outputs to the logic 1 state. Each pulse from IC1, corresponding to a press of the VOICE button, advances the count one step in its binary sequence. Diodes D1 and D2 permit the flip-flop to pull the radio's bank switch lines low, but block logic 1 voltages (5 volts) from reaching the radio.

Construction Details

Figure 2 shows a full-sized foil pattern, but any type of construction will do. The board should be made to the same overall dimensions, though, so that it will fit in the space intended for the voice board.

The radio's connectors are on standard 0.1-inch centers, but the matching sockets are simply not available in the U.S., as far as I can tell. Usable connectors can be made from standard male 0.25-inch high "header" type pins, available from Jameco Electronics and Digi-Key. The pins are a little slim, though, so bend them just a little to insure a good connection. The 2-pin connector should be attached to the selector board by about 5 inches of 2-conductor wire, and can be made from the same type pins, bent at a right angle. You can also use a right-angle header. Lay the board solder side down so that the two rows of four holes are facing left, and lay the wire assembly to the left of the board, with the pins facing up. Now, connect the wires to the two outermost holes nearest the front of the board, making sure there are no twists in the wire. (See Figure 3.)

When installing C1, D1 and D2, be sure to observe proper polarity. And, of course, be careful that the ICs are correctly inserted.

Installation and Operation

Disconnect power from the rig and install the board, with the connectors on the left, and screw it down with two screws. (See Figure 3.) Now, locate the radio's two connectors, which will be lying near the installation location. (If you're not sure where to install the board, see page 44, section 9-5, of the owner's manual.) Install the 8-pin connector with its flanges facing left, and the 3-pin one the same way. Finally, take the selector's 2-pin and press it into the top of the REAR two pins of the four-pin on the right of switch unit F (just to the left of the installation site), gently pulling the existing wires to the left in order to make room for entry. See Figure 4 for connector details.

Close the rig up, reconnect power, set the bank switch to Bank 4, and fire it up. Press the SCROLL button until the LCD displays a memory location. The first number should be 4, indicating Bank 4. Press the voice switch, and it should move to Bank 1. Each press will increment it by one. If the order is incorrect, you may have wired the selector's 2-pin backwards. The easiest way to correct it is to reverse the wires going to the board, and leave the connector alone. Be sure to completely remove it from the radio first, to avoid any potential static problems or short circuits.

A Bonus

The selector resets to Bank 4 upon power up, effectively making it disappear. The bank switch still works and can be used to preset the rig to a specific bank for timer recording of shortwave broadcasts. Don't forget, though, to set it back to Bank 4 for normal operation. If you leave it in another bank the banks won't step properly, but no damage will be done. Just reset the switch and all will be fine. Enjoy the other 30 memories in your '940! 73

Michael Jay Geier KB1UM invented the Memory Bank Selector in 1986. It was marketed by Inventron Labs as "The Banker" in 1987. KB1UM is 73's troubleshooting "Ask Kaboom" columnist. You can reach him at PO Box 64766, S. Burlington VT 05406.

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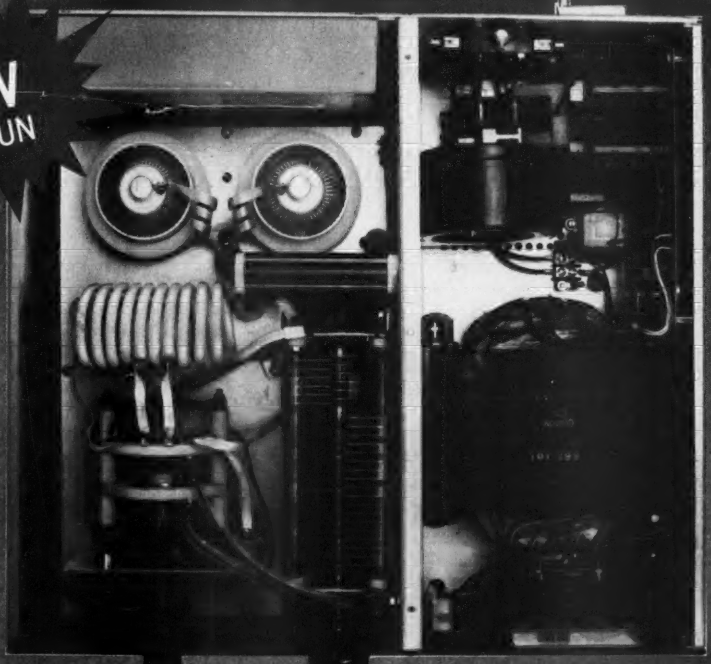
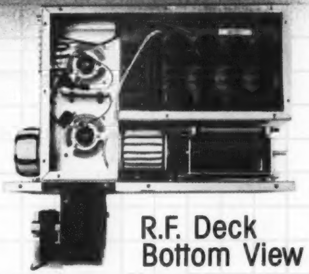


Chassis Top View

R.F. Deck
Top View



R.F. Deck
Bottom View

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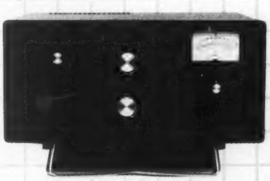
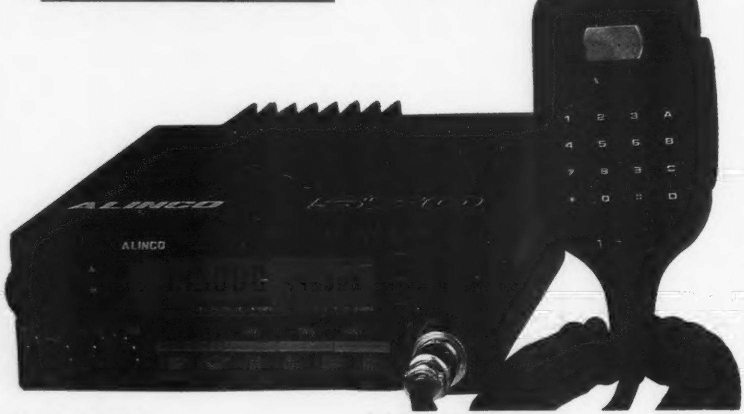


CIRCLE 30 ON READER SERVICE CARD

ALINCO ELECTRONICS

The Magnificent Six Gives You More Power



DR-570T

Set your sights for dual!

The Alinco DR-570T "Twin Bander" has dual LCD readout, volume, squelch and tuning controls. Double barrelled power with 45W on 2M and 35W on 70 cm, plus simultaneous receive on both bands or intermix with four modes of scan. The DR-570T will win the "battle" with its illuminated front function panel and LCD readout, readable in any lighting conditions. Don't let the "Tiny" DR-570T fool you! It's fast, and leaves the competition in the dust with many standard features you expect. Cross band repeat with the flick of a switch. Full duplex, 20 memory channels, call channels, 16-key DTMF Microphone, and subtones are just a few. "Reach" for the DR-570T today!

DR-510T

Best Dual Value on the Market!

The Alinco DR-510T has most of the outstanding features of it's sister the DR-570T, including 14 memory channels, cross band duplex and cross band repeat. The multi color LCD display, and simple tune control panel makes simplicity the key word. The DR-510T with 45/35 watts is the best, feature-packed dual bander on the Amateur market today. See the DR-510T along with the other Alinco "Magnificent" ones at your favorite dealer today!

DJ-500T

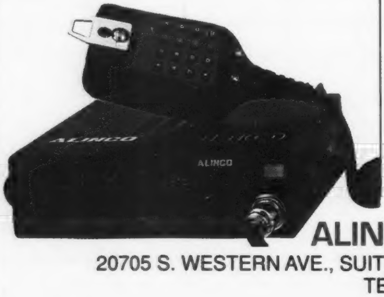
Power-Packed Dual Handi!

20 Memory channels, subtones, built-in DC to DC, 700 mah nicad battery, LCD readout with 6W on 2M and 5W on 70 cm (with optional battery) call channels, DTMF Touchtone, and direct keyboard entry, are just the few winning features of the Alinco DJ-500T Dual Band Handheld. Easy to use, and Value Priced at your Alinco Dealer.

DR-110T&R-410T

Tiny 2M Power From Alinco!

DR-110T, this 2M Alinco, enters the nineties a proven winner with the "reputation" of best value. The DR-110T packs a powerful 45W on 2M and sports all the features you expect in todays transceivers. Tuning is a snap with the multi-functioned easy-to-see keyboard, 14 memory channels, subtones, scan, multi- colored LCD readout, reverse, are a few of the many features of the DR110T. The mobile of the future — today! DR-410T available for 70 cm.



DJ-100T&DJ-200T

Best 2M Micro Value Anywhere!

The Alinco DJ-100T is "Magnificent" for its tiny size, but stands up to the competition with power and capability. 10 memory channels store offsets and subtones. Has LCD readout with call channel and reverse at your fingertips. 500 mah battery with direct DC to DC is standard. 3W on standard battery, 6W on optional battery leaves the competition in the dust! DJ-200T for 220 MHz.

DJ-160T&DJ-460T

2M H/T is here! And wow!

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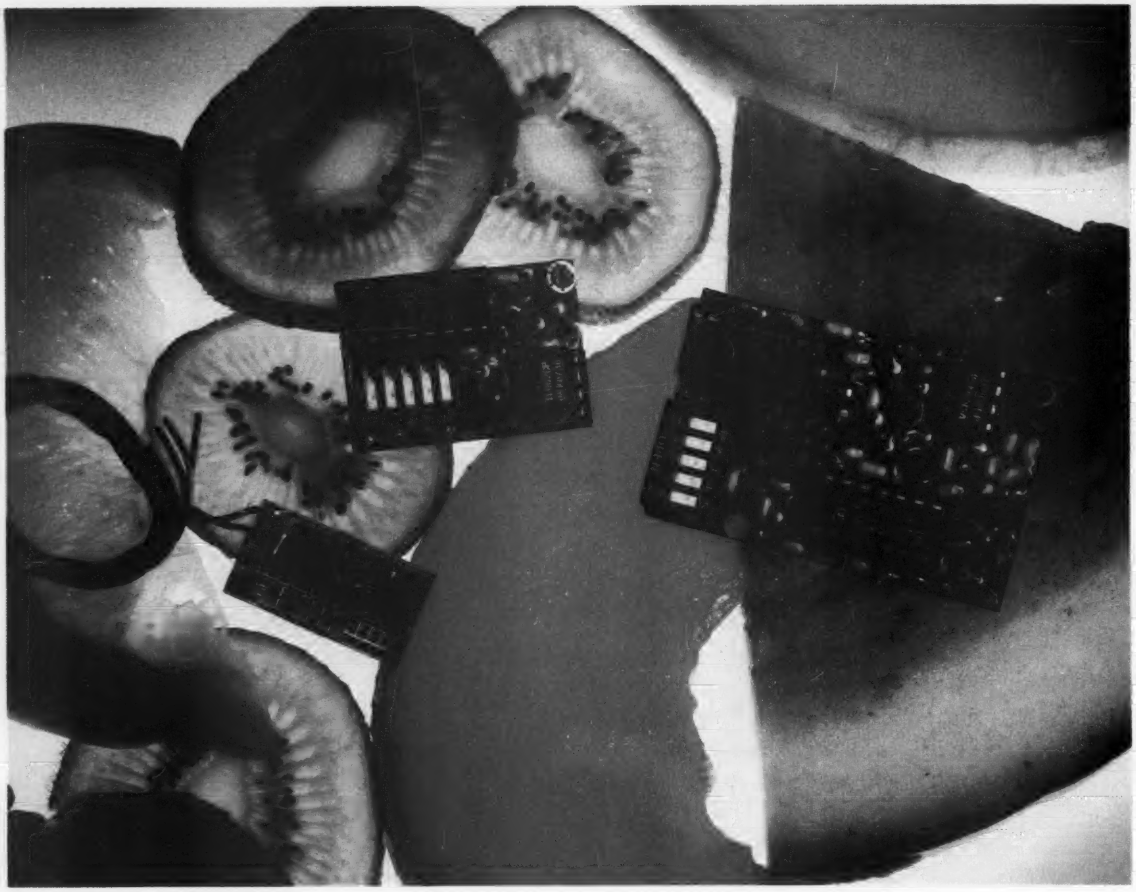

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LOOKING WEST

Bill Pasternak WA6ITF
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The Dawn of the New Decade

No-code is on its way, but Novice and Tech may be on their way out! The Commission is proposing to amend its rules by establishing a codeless class of amateur operator license to be called the "Communicator Class." The long-awaited action on no-code came the morning of February 8, with many surprises, including the eventual abolition of two license classes by attrition.

Under the FCC proposal in P.R. Docket 90-55, the Communicator Class would be incorporated into a simplified licensing structure containing four ascending steps: Communicator, General, Advanced, and Amateur Extra classes. Current Technician and Novice Class operator licenses would be grandfathered indefinitely, renewable and modifiable, but no new licenses would be issued for those license classes.

The codeless operator class license would satisfy three major objectives. The first is to offer an entry level license for all persons who find telegraphy a barrier to joining the amateur radio service. The second objective is to design a codeless license that can easily be incorporated into the current licensing process. The third objective is to avoid any negative effect upon current licensees, the volunteer examiners who administer amateur examinations, or the Commission's workload.

According to the Commission, the Amateur Radio Service exists for the purpose of self-training, communication and experimentation by duly authorized persons interested in radio technique, and whose aim is solely personal, without financial gain.

Upgrading from Communicator

Until now, individuals seeking a license to operate an amateur station must prove that they can send correctly by hand, and receive correctly by ear, text in Morse code signals. Although this requirement may be waived for an operator of an amateur station transmitting only on frequencies above 30 MHz, each of the five current classes of operator licenses issued by the Commission requires the applicant to pass a Morse code examination.

Although the Communicator Class operator license would not require knowledge of Morse code, a Communicator Class licensee who passes or receives credit for a telegraphy examination would receive the privileges of the Technician Class. Upgraded Communicators would be required to sign "/AC" after their call. The upgrade from Communicator to Communicator/AC would be handled totally by the VECs. No new license or callsign would be given, and no FCC action would be taken.

The FCC staff could not explain why a code test was chosen as the means to obtain added VHF privileges, other than to state that that was what the ARRL wanted.

Communicator Class Privileges

Privileges for the Communicator Class would include all emission types, replace two existing beginner operator classes, and simplify the amateur operator license structure.

The Commission would require applicants for the Communicator Class license to pass a 60-question written examination. The new question pool would be comprised of the questions from the two pools currently used in the Novice and Technician license examinations, along with some additional material. The Communicator class test itself will consist of 30 questions from the Novice question pool, 25 from the Technician question pool, and five newly-created questions.

Candidates for a Communicator license would be tested through the volunteer examiner program. Since the Communicator class will replace the Novice class license, this would automatically bring all amateur radio testing under the VEC program.

The proposed transmitter power for the Communicator class would be 200 watts PEP. The licensee's station would be eligible for a Group D callsign. Stations with Communicator class control operators would not be permitted to transmit on the 2 meter or six meter VHF bands, or on the HF bands.

Feedback Requested

First, the Commission is requesting comments on all aspects of this proposal, with emphasis on the effect of excluding Communicator class licensees from the two VHF bands. Second, any comments are welcome on whether it's desirable to allow Communicator class licensees to operate on-the-air telegraphy on the HF bands. Any HF privileges that the final report and order might grant to Communicator licensees would be limited to domestic communications only, so as to stay within the terms of the WARC treaty. No cross-border or out-of-continent contacts would be allowed.

The FCC proposal differs in several ways from the ARRL no-code proposal in RM-6995 and other no-code requests. The February 8 release of Docket 90-55 proposes to stop issuing Novice and Technician class licenses so that the one point of entry into amateur radio would be the Communicator. This is substantially different in philosophy from what the ARRL and other petitioners had envisioned, but it is also not altogether surprising. With continued government cost-cutting, it appears as if the FCC is taking the occasion of the creation of the Communicator class license as a way of long term cost-reduction for itself.

On another front, the Technician class is the fastest growing of all license classes, and wields considerable political clout in the 1990s. Techs will not want to give up this political might, and they will probably fight to retain full licensing of this class, or request "grandfathering" to the next higher class of license.

There will be a comment period of six months. Comments on PR Docket 90-55 are due August 6 with replies expected no later then September 7, 1990. A good guess is that a final report and order to create the Communicator will be issued either at year's end, or at the Dayton Hamvention in April of 1991!

Excerpted from the Westlink Report with assistance from the ARRL, WA3VJB, KB4KCH, KC5CW, W5YI and W6RCL ...de WA6ITF

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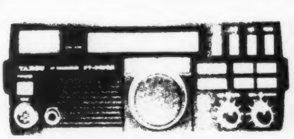

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More on Synthesizers

Last month we discussed the basics of frequency synthesis. As I hope you'll recall, we explored the concepts of the voltage-controlled oscillator and the phase-locked loop with its programmable divider. Now let's see what it takes to fix one of these beasts when it fails.

Is it Really Broken?

Before you try to fix your synthesizer, be sure it is actually broken! Many radio failures can cause the same result—a dead rig. It's important to use the process of elimination to avoid attacking the wrong circuits.

Does the power supply come on? If there are no lights or displays, the problem is in the supply, not the synthesizer. Is there any reception or transmission at all? Even if signals are weak, any operation on the displayed frequency indicates a working synthesizer. Does the frequency display show digits and tune properly as you turn the VFO knob? If not, the microprocessor and/or its associated display circuits are not working. Try the internal RESET button, and also check the lithium backup battery.

In the case of older ICOMs, a dead battery will wipe out the internal operating software, forcing you to send the memory board back to the company for reprogramming. In other rigs, a dead battery will cause memory loss, but the rig should still work. However, some rigs behave erratically when the battery is near the end of its life, so always check it before assuming a circuit problem. If the battery is of the usual flat lithium variety, it should measure 3 volts. Even a little less suggests imminent cell failure. If the battery is soldered in (most are), you may have to order it from the manufacturer. If there is another source of lithium cells with solder tabs, I'm not aware of it. (Any of you know of one?)

Scope It Out

Having gone this far, if you're convinced you have a real problem with the synthesizer, take a good look at your test equipment before you plunge ahead. Don't even *consider* attempting a repair unless you have a scope. This stuff is just too complex for VOM tracing. (Besides, the circuits operate with narrow, rapid pulses that just won't show on a meter.) A frequency counter is also very helpful. And of course, you'll need a schematic diagram of the rig. Finally, ask yourself whether you feel competent to do the job. Especially if the trouble is digital, some background knowledge is essential. Are you familiar with buffers, gates, data busses and microprocessors?

I'm not saying you have to be a whizbang programmer or a circuit designer, but you should at least know the difference between data and addressing, and have some idea of how RAM and ROM are used. You wouldn't drive a tractor-trailer if you didn't know how, so why mess up your expensive rig? But if you're ready, let's go.

Digital Woes

If the battery is good but the display or tuning knob operate incorrectly, then you may have a digital problem. Digital circuits rarely fail intermittently, except in the case of a cold solder joint. If an IC goes, it goes, the usual result being a pin stuck high or low. If this should happen on the data buss, odd things can happen. The rig may skip frequencies, or refuse to tune at all. The display may have segments stuck on or missing. Or the frequency of the rig may not match the display. I remember one case in which the mode (USB, CW, etc.) indicators wouldn't light, and the rig wouldn't TX or RX. But the display and tuning seemed fine. The trouble turned out to be two bad buffer chips used to send data to the mode control circuitry. They also had to drive the LEDs, and the extra current finally blew them.

If you've got no display at all, check the supply line going to the microprocessor and display circuitry. Usually, it's 5 volts. Sometimes, small 3-terminal regulators are used, and they can blow. If the voltage is there, scope the crystal used as the clock for the micro. If you see a waveform (usually a few MHz) on either crystal connection, then you know the clock is going. Although micros can go bad, it is unusual. More likely, the trouble is with an input/output (I/O) chip, or a memory chip. Make sure you are static-discharged, and then touch the top of each chip for a few seconds. If any one of them is very hot, then it is probably bad. They can, however, get a bit warm in normal operation, so don't be too zealous about this.

Check for pulses at the data and address lines of the micro. If some are there, the chip is probably OK. If possible, try to follow a simple function (like a mode selection) all the way to its indicator. If the voltage disappears along the way, you've found the trouble. If the display tunes but the rig is absurdly off frequency, check that data is going to the digital dividers. While you're there, check the inputs and outputs of the dividers for the presence of signals. An input with no output indicates a bad divider. Lack of an input signal suggests a bad VCO, which means you'll have to head for analog territory.

Detailed analysis and troubleshooting of the digital system can be next to impossible, because service manuals often don't describe the complex operations in great detail. If the tests so far haven't located the trouble, now might be a good time to find the shipping box and send the rig off for factory service.

Analog Blues

If the digital system seems to be working but the rig still won't play, you may very well have an analog problem, which is generally much easier to find than the digital stuff. Usually, one of two disorders will occur: an oscillator won't work at all, or it will be way off frequency.

The first thing to do is to check for the presence and function of any crystal oscillators which are mixed with the synthesizer's VCOs. There may be more than one. A dead crystal or other malfunction can stop the operation of the whole synthesizer, even though everything else is OK.

Next, scope each voltage-controlled oscillator. There may be several, as multiple loops are common. Be aware that some designs have more than one VCO per loop, and switch in the appropriate one according to which band you select, leaving the others turned off. If the rig works on some bands but not others, it's a dead giveaway that one VCO is not working.

Put the probe at the oscillator's output, where it feeds the rest of the rig. If there's no signal, and that oscillator is intended to be in use for the band you're tuned to, you've found your trouble. (If you're not sure which VCO comes on when, try various bands. They should all come on sooner or later.) Troubleshoot the oscillator as with any other. Most likely, the problem will be a bad transistor or an IC. Some oscillators have small trimmer capacitors to ensure that the oscillator will start. A bad or dirty trimcap can kill the oscillator. IC-745s often had this problem.

If the oscillator signal is there, check the DC control voltage coming into the varactor diode (which looks on the schematic like a cross between a diode and a capacitor). If it is swinging wildly, or is at ground or the supply voltage, then something is bad in the feedback network, which consists of the phase detector, loop filter, and DC amps. Occasionally, the VCO can be so off-frequency to begin with that the control voltage can get into an abnormal state trying to correct it. Especially if there's a trimcap, try adjusting the oscillator slightly. It may bring things back to normal. If not, start tracing back through the DC amps and loop filter. You may find a bad transistor. If not, check the phase detector. It has two inputs, one from the programmable divider and one from the reference. If they're there, check for an output. If there is none, the detector is bad.

Around and Around

Because synthesizers are loops, they can be tough to fix. If you've never done it before, you may go around and around for hours, because inputs affect outputs and vice versa; almost everything is dependent on everything else. The one circuit (besides crystal-controlled mixing oscillators) which is independent is the reference, so if all else fails, start there.

Given the complexity and diversity of today's synthesizer designs, there's no way we can cover all the intricacies in a column. I hope, though, that I've given you enough information to help you handle some of the more common failures. Now, let's look at a letter:

Dear Kaboom,

Two questions. First, what is the proper impedance mike to use with my TS-520S? The rig's input impedance is 50k ohms. Also, I've enclosed the diagram of the muting circuit of my R-1000 receiver. How do I make it mute?

Signed,
Shhhh

Dear Shhhh,

Always try to use a mike with the same impedance as the rig's input. In your case, a ceramic or crystal mike, or a dynamic with a matching transformer would do the trick. If you try a 600 ohm mike, you will find your audio very weak. As for the muting, it appears from the diagram you sent that grounding pin 7 of the remote jack would turn Q14 on and mute the receiver. The 47k ohm resistor (R113) ensures that very little current will flow through pin 7, so just about any method, such as a relay, switch or transistor, that connects the pin to ground, should work.

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Number 12 on your Feedback card

TECH TIPS

Pearls of Tech Wisdom

Zero Beat Revisited

It is impossible to directly zero-beat a carrier using normal amateur equipment because the receiver audio usually won't pass much below 300 Hz. There is a way to do it to an accuracy of one or two hertz without using any test equipment or transfer methods, just the front panel controls of your transceiver.

You'll need two pieces of equipment: a receiver or transceiver (T/R) capable of AM and SSB reception, and a station transmitting a known RF frequency using AM mode and modulated by any steady audio tone between 500 and 1500 Hz (such as the National Bureau of Standards station "WWV" on 5, 10, 15, and 20 MHz.).

Warm up your T/R for at least 30 minutes. Then tune in the transmitting (TX) station fairly closely, using the AM mode on your T/R. Next, set your selectivity wide open, usually 6 kHz. This is a must!

Switch the T/R mode to SSB (LSB or USB), keeping selectivity wide open. Slowly tune for zero beat of the two audio tones (the tone transmitted by the TX station and the tone generated within your own SSB receiver). The difference between your dial frequency and the known RF frequency of the TX station is the error in your master osciliator. Note the difference, plus or minus. When zero beat is achieved it will sound like one pure tone. When you get close to zero beat you can actually count the beats but remember that the frequency difference is one half of the beats you count. If your error is less than 10 Hz you can probably live with that unless you're a perfectionist. No adjustment necessary. If the beat note sounds the same when tuning 10 Hz above and below the known frequency you are very close to zero. Most modern T/Rs only tune in 10 Hz increments, anyway.

To adjust your master oscillator set the dial to the frequency of the known TX station and carefully adjust the master oscillator trimmer for another zero beat of the audio tones. The higher the RF frequency of the selected TX station the more accurate your results will be. One other advantage of this procedure is that after calibration, when your T/R is cold, you can take a reading and follow it up in frequency until its drift is stable and see how long it takes to reach temperature stability. Also, choose a time when the TX station signal is fairly stable with little QSB.

Roy Tabeling W4IFW
4727 South Tropical Trail
Merritt Island FL 32952

Try Hot Glue!

Have you ever been left holding a small item, such as a relay, and can't figure a method of mounting it? Ever build a small adjunct circuit board and wonder how you will hold it in place? Ever wonder how to fasten wires down so they can't flex? Here is my solution: Get a hot glue gun!

A while back I was given a hot glue gun for use on odd repair jobs around the house. It is handy and very easy to use. Just plug it in, wait for it to heat up, and pull the trigger (or push the glue bar) to force hot liquid glue out the nozzle.

The glue I use is flexible after flex-up (about 30 seconds) and adheres to everything I have tried it on. Some examples I have used hot glue for:

- Stand-offs and mounts for circuit boards.
- Fastening relays to chassis.
- Anchoring wires to exiting chassis.
- Weatherproofing coax connectors.
- Sealing antenna wire wall entrances.
- Vibration-proofing mechanical parts.
- Insulating bare wires.
- Anchoring coax wire to walls.
- Mounting hardware such as mike hooks.
- Weather-sealing bulkheads in cars.
- Attaching feet to equipment.
- Hand-forming grommets.

The list could go on and on. Use your imagination.

Glue guns are available at Radio Shack, Sears, and most hardware stores for less than $12. One passing thought: I was in a craft supply store recently and purchased a very small hot glue gun. The glue sticks are only the size of a pencil. It is a little easier to handle in those tight spots. It cost $2.95 and I got 25 glue sticks for a dollar.

Bill Clarke WA4BLC
Box 2403
Falls Church VA 22042

Easy Radial System

Most of you know that a vertical antenna won't work worth a flip without a decent radial system, but you'd rather roll naked in broken glass than do it. It's a real chore!

Just attach a pizza cutter to a shovel, hoe or other handle with a couple of worm drive stainless steel auto water hose clamps. When the area is well-watered follow behind with a roll of soft aluminum wire and a hammer and stake for driving. Water again when finished.

Using this method, hundreds of feet can be done in just a couple of hours. No blisters, no sweat. (The radials do NOT have to be perfectly straight.)

Terry Staudt, L.P.E., W0WUZ
616 N. Sheridan
Loveland CO 80537

Number 24 on your Feedback card

UPDATES

We Did it Again!

See the "KB1UM's Flavorig" update in the February 1990 issue on page 59. The correct source and number for L6 (10 mH) should be Digi-Key M7103.

ARS WOCUO

The Grand Island ARC notified us that they had sent in the wrong post office box number with their special event station announcement (see page 50 of the March issue). The correct address to QSL is ARS WOCUO, PO Box 462, Grand Island NE 68802.

D.R.I.G.'s Phone Number

See February's "Hamsats" column, page 52. The correct phone number for the Dallas Remote Imaging Group's bulletin board, which incorporates the AMSAT Bulletin Board System, is (214) 394-7438.

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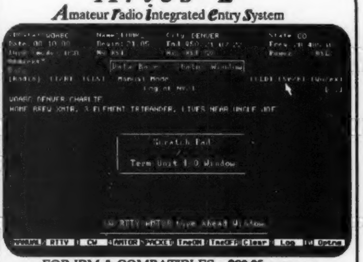

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CIRCLE 92 ON READER SERVICE CARD

Cassette Box Special

Replace that Guy Lombardo tape with a 5-watt 80m transceiver!

by Michael Jay Geier KB1UM

The search for suitable cabinets for my electronic projects has led me to everything from Radio Shack project boxes to dessert containers to pillboxes! My perennial favorite, though, is the cassette box. These cheap little gems are great for lots of things, including meters, battery holders, switchboxes, and even entire perfboarded circuits. And after I've used my $1.50 housing, I still have a cassette! What a bargain.

So, naturally, it seemed like a good idea to try to build an entire transceiver inside one. As it turned out, it wasn't even an especially tight squeeze.

I wanted the rig to be stable and sensitive, to have some active filtering on the receiver, and to generate sidetone in transmit. Also, it should include a key, and put out enough power to make real contacts. And, as always with my projects, coil winding should be kept to a minimum (I hate winding coils).

The result is the Cassette Box Special. It's a 5-watt, 80-meter crystal-controlled rig with a direct conversion receiver. It has only one very simple coil to wind, and only one set-and-forget adjustment! It uses 12 volts, and pumps audio to a pair of "Walkperson" headphones.

Circuit Description

Q1 is the crystal oscillator for both receive and transmit. It's a MOSFET. Radio Shack used to carry it, but has discontinued it. Check your local store—there are still plenty of them on the shelves. In fact, that's where I got mine. If you can't find one locally, you can order it from the parts supply sources shown at the end of the article.

In transmit the oscillator's output, shifted down approximately 700 Hz by C4, feeds Q2 (the driver), and Q3 (the final), which is also a MOSFET (and is still in the Radio Shack catalog). The driver and final are keyed together, while the oscillator runs full time. Q3's output is filtered by L4 and its associated capacitors, and fed via the TX/RX switch to the antenna. C15 generates the sidetone by forcing the audio amps into oscillation. R14, at the audio output, cuts the sidetone level down to keep it from knocking your head off.

In receive, the oscillator feeds gate 2 of Q4, the mixer. Gate 1 is fed with the incoming signal, tuned by L1 and C12. Careful attention to the design of the input coupling (by L2 and C11) results in minimal detection of unwanted AM signals. The mixer's output is fed to the high gain audio stages, Q5–Q7. Capacitors in the gate and drain leads of Q5 form a low-pass filter, removing some of the high frequencies which may be present in the received signal. C20, in conjunction with audio output transformer T1, provides a strong peak in the audio passband around 700–800 Hz and, with Q6, forms a fairly steep active filter. The transformer feeds the "Walkperson" headphones, driving them with plenty of volume.

Finding the Parts

The TX/RX switch has to perform six functions, so a single 6PDT switch is your best bet. You can buy one, or you may be able to scrounge one up for almost nothing. Kiddie walkie-talkies and cassette tape recorders have this type of switch—you may have a few lying around. I got my switch at a hamfest. Of course, you can also gang several switches together, or even use a relay, though it had better be a small one if you want to get this thing into a cassette box.

The crystal can be a surplus unit or one ordered from a crystal house. Try to get a high-activity crystal. Most rocks work well, but some can be sluggish, reacting badly to

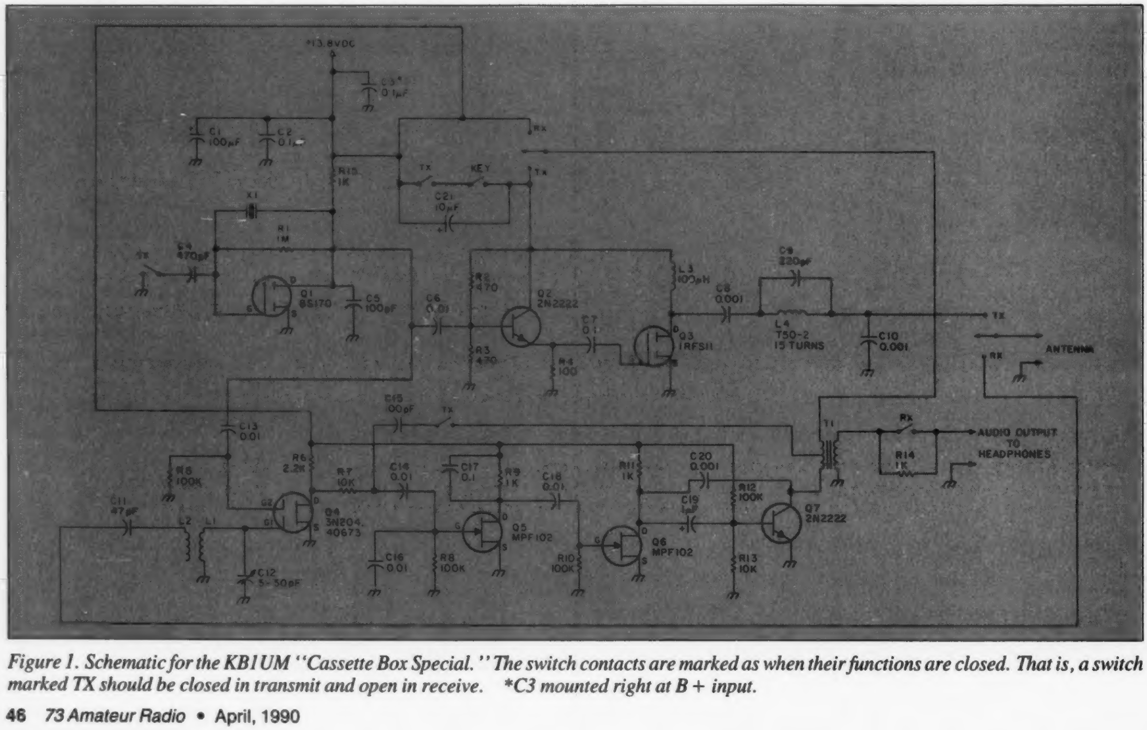
+13.8VDC
C3* 0.1µF
C1 100µF
C2 0.1µF
R15 1K
X1
R1 1M
TX
C4 470pF
Q1 BS170
C5 100pF
RX
TX
KEY
C21 10µF
C6 0.01
R2 470
R3 470
Q2 2N2222
C7 0.1
R4 100
Q3 IRF511
L3 100µH
C8 0.001
C9 220pF
L4 T50-2 15 TURNS
C10 0.001
TX
RX
ANTENNA
C15 100pF
TX
C13 0.01
R5 100K
R6 2.2K
R7 10K
C11 47pF
L2
L1
C12 5-30pF
Q4 3N204, 40673
C14 0.01
C16 0.01
R8 100K
C17 0.1
R9 1K
C18 0.01
Q5 MPF102
R10 100K
R11 1K
Q6 MPF102
C20 0.001
C19 1µF
R12 100K
R13 10K
Q7 2N2222
T1
RX
R14 1K
AUDIO OUTPUT TO HEADPHONES

*Figure 1. Schematic for the KB1UM "Cassette Box Special." The switch contacts are marked as when their functions are closed. That is, a switch marked TX should be closed in transmit and open in receive. *C3 mounted right at B + input.*

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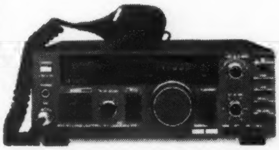

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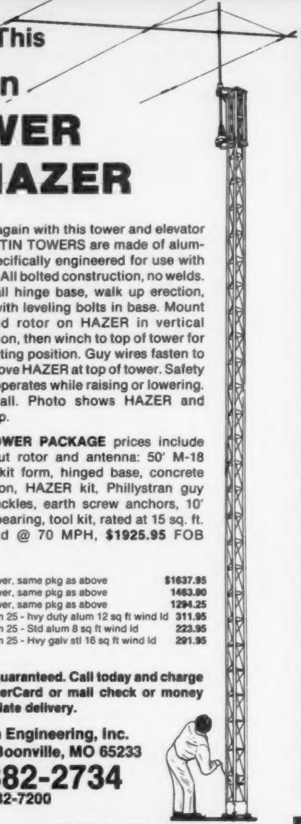

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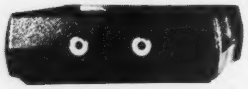

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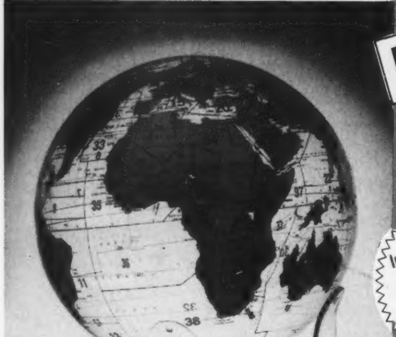

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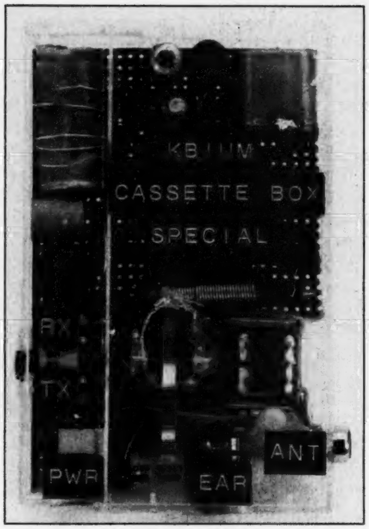

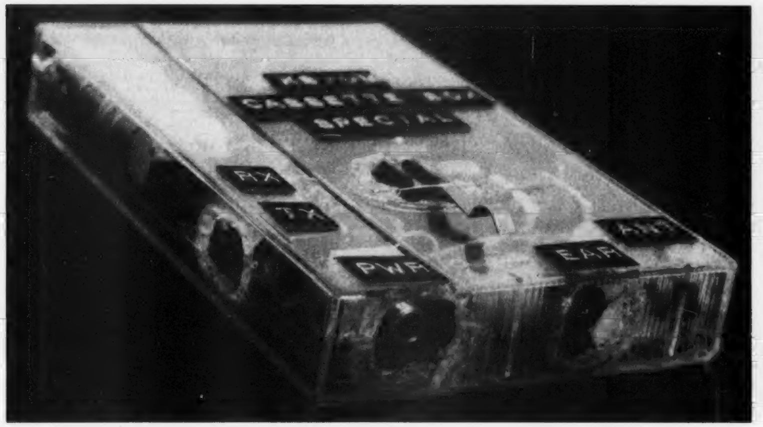

The "Cassette Box Special" 80m CW transceiver.

Parts List

Q1	BS170	Digi-Key BS170
Q2,Q7	2N2222	RS 276-2009
Q3	IRF511	RS 276-2072
Q4	3N204 or 40673	Jameco 40673
Q5,Q6	MPF102	RS 276-2062
X1	CRYSTAL	
L1	AM antenna coil from radio	
L2	5 turns spaced over length of L1	
L3	100 µH choke	RS 273-102
L4	15 turns #26 enameled wire on T50-2 toroid	Radiokit T50-2
T1	1KΩ CT to 8Ω audio output transformer	RS 273-1380
C1	100 µF, 25V or more	
C2,C3,C7,C17	0.1 µF	RS 272-109 (5 per pack
C4	470 pF	
C5,C15	100 pF	
C6,C13,C14, C16,C18	0.01 µF	
C8,C10,C20	0.001 µF	
C9	220 pF	
C11	47 pF	
C12	5–50 pF trimmer	RS 272-1340
C19	1 µF, 25V or more	
C21	10 µF, 25V or more	
R1	1 megΩ	
R2,R3	470Ω	
R4	100Ω	
R5	100KΩ	
R6	2.2KΩ	
R7,R13	10KΩ	
R8,R10,R12	100KΩ	
R9,R11,R14,R15	1KΩ	
RX/TX SWITCH 6PDT		
Heatsink	TO220	RS 276-1363
Sources:	Digi-Key Corp. 701 Brooks Ave. South P.O. Box 677 Thief River Falls MN 56701-0677 (800) 344–4539	Radiokit PO Box 973 Pelham NH 03076 (603) 635–2235

the change in load presented to the oscillator when you key the rig. In particular, avoid 3.579545 MHz colorburst crystals, as many don't work too well. Besides, using that frequency is just asking for TVI problems, both to and from your neighbors. You'd be amazed at how loud their TVs' color oscillators can sound in your receiver. Good frequencies to try are 3.560 MHz and 3.710 MHz, the recognized QRP frequencies.

The type of crystal you use may affect the amount of transmit offset provided by C4. For more offset, increase the value of C4; for less, decrease it. You can get multiple frequency operation by using more than one crystal and a selector switch, if you can fit it all in the box. If the frequencies are as widely spaced as those two, though, you may have to retune C12 when you switch frequencies.

L1 is an antenna coil from an AM transistor radio. At worst, you can buy a radio and remove the coil. I used one from a Radio Shack Flavoradio, and it worked fine. Just about any AM coil should do. If it has a tap or other windings, leave them unconnected and use the longest winding. Simply remove the coil from its ferrite core and then wind 5 turns of wire-wrap or similar wire around it, spread out over its length, to make L2.

Winding

There's only one coil to make. Get a T50-2 toroid and wind 15 turns of #26 enameled wire, spreading it two-thirds around the toroid. Coat it with nail polish to hold the windings in place, and you're done.

Construction Details

The key word here is "flat." First, prepare the cassette box. I used a clear one, and I suggest you do the same. They're popular and easy to find, and the result is pretty and interesting. Separate the two halves, and then clip off the spindles with a pair of dikes. Be careful not to crack the box, as the plastic is very brittle. Now, run your soldering iron over the spindle stumps to flatten them out.

A few words about working with this kind of plastic: The only way I've ever found to do it is with heat. Attempts at drilling resulted in a cracked or broken box. The stuff melts easily and can be shaped or formed any way you like. Try not to breathe the smoke, though, as it can't be very good for you. Also, always wipe and tin your iron tip after it touches the plastic, or the tip may become too contaminated to melt solder. If possible, use a separate, cheap iron to do your plastic melting.

You will have to make some holes in the box, but save that until after you've built the board, because the holes' locations will depend on your placement of the switches and jacks.

Cut a piece of perfboard to fit the cassette box. If you use the Radio Shack audio output transformer, as I did, you will have to cut away enough of the board to allow the transformer to fit in the box, because it is too thick for mounting on the board. In fact, the transformer doesn't quite make it as it is, and the plastic flanges where the wires exit will have to be melted a little to make it slightly thinner. If you can get a smaller transformer, do so, although you may have to experiment with the value of C20 to make it resonate around 700 Hz. The exact frequency isn't critical; you just want it to peak somewhere near the CW pitch you like to hear.

The final transistor must be heat-sinked. Don't forget to use silicone heatsink grease for efficient heat transfer. Bend the fins of the heat sink flat so it will fit into the box.

Assemble the circuit, placing the TX/RX switch and power, earphone, and antenna jacks at the edges of the board. Although layout isn't critical, try to keep the audio output transformer away from the antenna coil (L1/L2), or feedback can occur. Be especially careful to wire the TX/RX switch correctly. I have marked the switch contacts as to their function when closed. That is, a switch marked TX should be closed in transmit and open in receive. The two double-throw contact sets are marked in obvious fashion.

If you can't find a 100 µF capacitor (C1) that's thin enough, use two 47 µF caps in parallel. The exact value isn't critical. Also, place C3 (0.1 µF) right at the DC power input jack for maximum protection from RF feedback and instability.

I used an eighth-inch earphone jack for DC power, a stereo jack for the headphone output, and a phono jack for the antenna. Wire the headphone jack using only the tip and midpoint, leaving the ground (ring) unconnected. That way, the left and right phones work in series, which seems to provide the best sensitivity. Also, I used a microswitch with a lever arm for the key, mounting it on the board so that it stuck out through a hole in the top of the box. If you elect to use a separate key, keep the wires under one foot in length. Do not use an electronic keyer, as all the current for the transmitter passes through the key!

After assembly, check for any wiring or polarity errors. Be especially careful to match the polarity of the DC power jack to that of your power source! Next, place the TX/RX switch in receive and then connect power, antenna, and headphones. Adjust C12 for maximum signal or band static. It should sit at about ¼ total rotation. The peak is very sharp, and it may take a few tries before you get it just right. I made a hole in my box so that I could touch it up if necessary.

Slide the board into the large part of the cassette box and mark the spots for the holes for the switch, key, and jacks. When you're done making them, assemble the box and melt the edges together. That's it!

Operating Tips

The radio is designed to operate from 12 volts, and will work OK from about 10–14. At 12 volts, it produces approximately 5 watts in transmit. Use D batteries or a gell-cell, as the transmitting current drain is substantial enough to wipe AA cells out in short order.

Like most direct conversion rigs, the receiver is fairly microphonic. That is, if you tap on it, you'll hear it in the headphones. It should not oscillate or show any other kind of instability. If it does, try reversing the output leads from T1 (the side going to R14). Also, the rig is best operated on battery power, to avoid hum problems. In some locations you may get some hum induced from the table on which the rig sits because there is no shielding in the box. Try placing the radio on the battery pack.

There is, of course, no sideband filter, so you'll hear signals on either side of zero beat. If you hear a strong signal but get no response to your call, the other station may be listening on the wrong sideband to hear you! Oh well, such is life in the direct conversion world.

Finally, avoid long keydown periods. Although the rig is stable into all but the worst SWR, the heat sink is small and gets pretty hot. You'll notice the box getting warm, but it shouldn't be a problem with normal use.

Enjoy your "Cassette Box Special." You'll have fun with it on the air, and it's guaranteed to turn a few heads when you show it around! ■

Michael Geier KB1UM is 73's troubleshooting "Ask Kaboom" columnist. You can reach him at PO Box 64766, S. Burlington VT 05406.

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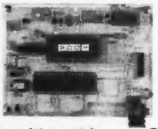

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DUP 4
REV 5
100K 6
SFT B/SC
APO T 7
SAVE T 8
F/CH 9
T SQL C/L L
CLOCK */▲
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PWR #/▼
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Back to BCNU

In February I began to look at ways to digitize images into a form that could be transmitted to an amateur over radio links, giving new meaning to the acronym "BCNU." While the previous board covered was directed more at the mainstream computer market, this month's entry has a clear vector into our sector.

MFJ Enterprises, Inc., is a company well known to many of us for its fine line of amateur radio equipment. They have entered this market with the MFJ-1292 "Picture Perfect" video digitizer. Aimed squarely at the amateur radio market, this board offers some features which uniquely suit it to the task at hand.

The MFJ-1292 is a ¾-length card, which can be installed in any available 8-bit slot in an IBM PC/XT/AT compatible computer. An onboard DIP switch allows configuring the board for other than the default port address of 0330 hex. Once plugged into the computer's bus, video input is fed to a jack on the card, and a small controller box, sporting brightness and contrast controls, is plugged in as well. The latter uses a small, 5-pin header plug that may take a bit of fiddling for less agile hands.

An external monitor may be connected as well to another RCA jack on the card. This may be useful for adjusting the contrast and brightness of the incoming image.

Using the "Picture Perfect" MFJ-1292

Once installed, the board is addressed through a supplied program, MFJPIC.EXE. Loading the program reveals options including:

A. Change digitizer port address
B. Digitizer brightness adjustment
C. Capture picture from camera into buffer
D. Display picture
E. Save raw digitizer data to disk
F. Load raw digitizer data from disk
G. Save compressed picture to disk
P. Save PCX format file to disk
S. Save multilevel SSTV image to disk

As you can see, other than just capturing and saving an image, you have quite an array of options.

This screen, and all subsequent options, are displayed on a simply formatted text screen. Either the initialed letter, or in some cases a function key, may be used to select an option. A mouse is neither supported nor required, and the only graphics display is for viewing a captured picture. This would presume that, if displaying an image was not a requirement, about any display would suffice.

Initially, the brightness of the digitizer may be adjusted by selecting option "B" and using an on-screen bar graph to set the contrast and brightness controls to mid range. Finer adjustments really require looking at each captured image, making the necessary adjustments, and capturing and viewing again.

Typing "C" initiates a capture, a process which takes several seconds. The image must remain stationary. Digitizing a moving image, such as a live subject or something on a television show, is very difficult.

Saving Your Data

Images may be saved to disk in a variety of formats. The most versatile, from the program's point of view, is raw data. This allows all other permutations to be selected at a later date. All other options lock you into the mode selected. A compressed picture format is provided, which is supported by MFJXFER, a program which can send pictures in this format over packet circuits. For general utility, the PCX format, also known as Z-Soft format and used in that company's PC Paintbrush series of programs, is also supported. Within that mode, data may be saved in five formats: B&W (640x200x2), CGA (320x200x4), EGA1 (640x350x16), EGA2 (640x400x16), and VGA (320x200x256).

Note that while display of an image on-screen is limited by the installed graphics adapter (a VGA image display cannot be accomplished on an EGA or CGA adapter, for example), you can save pictures in any of the above formats. Images can be saved at resolutions higher than what you have, for others' benefit.

Along with the MFJPIC program detailed above, the MFJ-1292 is supplied with several other useful routines. MFJVC.EXE allows you to view saved, digitized pictures, or pictures received over the air. A screen capture utility, MFJBCD.COM, allows graphics images from CGA, EGA, or VGA displays to be captured for later use. MFJBCC.EXE converts pictures saved by MFJBCD or MFJPIC to a format suitable for transmission over packet radio. This transmission may be accomplished by MFJXFER.EXE, another included program, or with MFJ-MULTI.COM.

A review of a digitizer would somehow not be complete without a sample image, and I hope Figure 1. fills the bill. This is a VGA mode (320x200x256) image of the same photo of my son that I used to look at the previous digitizer in the February column. With a gray scale pixel format you can stretch and shrink easier, but it does degrade sharpness a tad.

A Mixed Bag

Now, there is no facility to edit the saved pictures. This would presume some other graphics program which could handle the PCX format. A picture could be saved in PCX format, edited, and loaded back into the system in its revised form. No format conversion is possible, however.

Other problems with this system revolve about the timing and method of image capturing. The time required for an image capture is long enough that, as noted, a moving image cannot be used. I tried to have one of my children sit in front of the camera for this review, but settled on a photograph when it became apparent that a live target, at least a young one, is not a feasible subject. Further, the requisite lapse between adjusting the contrast and brightness and viewing the results makes obtaining the optimum setting a bit of a hit or miss situation.

For many situations, the gray scale type image produced by the MFJ-1292 is preferable to the dithered dots of other digitizers. Additionally, with packet picture interchange addressed, the MFJ-1292 fills a unique niche in the market. As I suggested, a mixed bag if ever there was one!

For amateur radio use, and some desktop publishing, where the gray scale ability of the MFJ-1292 is important, this may be the best card to have. For a package price of $199.95, this unit is well within range for many interested amateurs. Drop a note to MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762, for more information. As always, be sure to mention "RTTY Loop" when you do.

I remain available, albeit on an irregular basis, on CompuServe (ppn 75036,2501) and Delphi (username MARCWA3AJR) for your comments, questions, and critiques. Let's try to get out the soldering iron for next month's RTTY Loop!

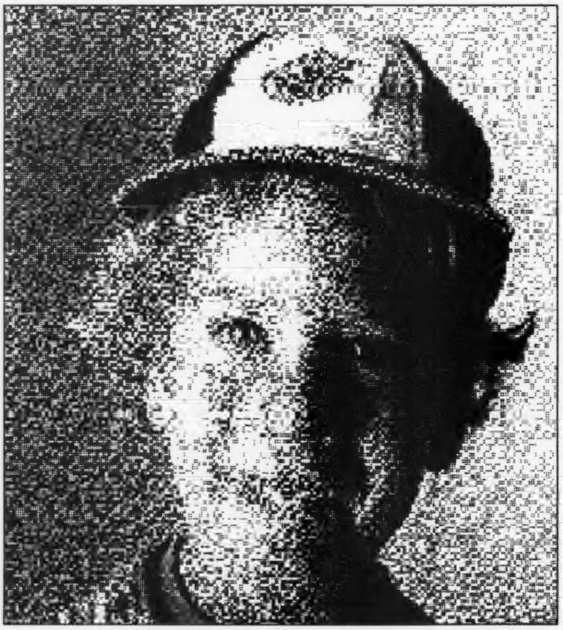

Figure 1. Photo digitized with MFJ-1292 at VGA (320x200x256) resolution.

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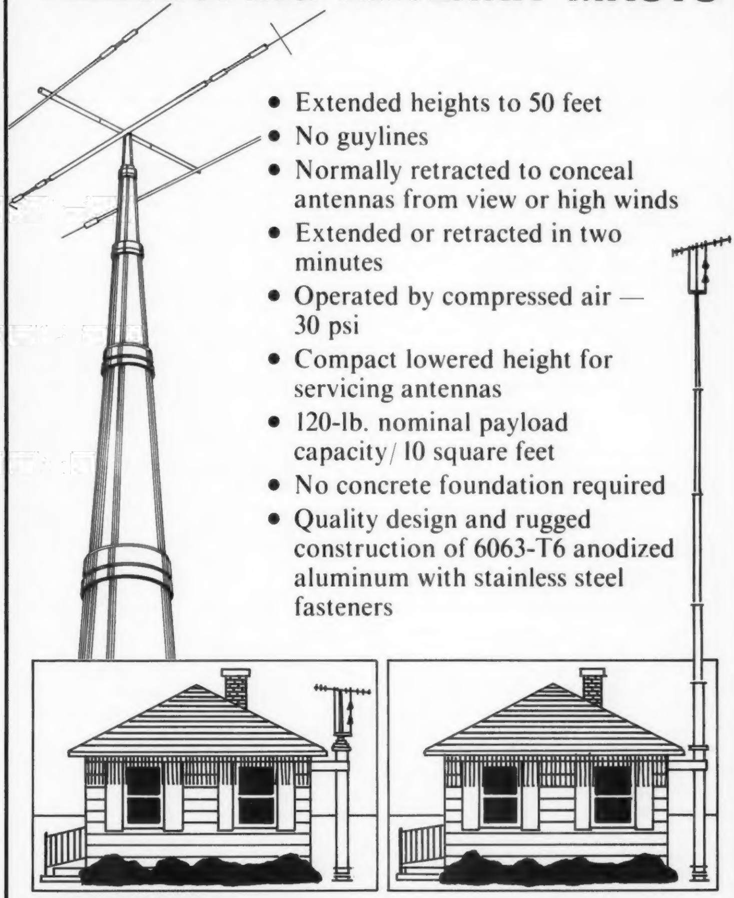

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More on the Univeral Interface

Gary Morris N6QAF suggests a change to the standardized radio/TNC interface I described in my article in the October 89 issue of *73*. It seems that Gary uses a Drake TR-4 on HF, and the TR-4 requires that a positive voltage be applied to the Push-to-Talk (PTT) line rather than the more common technique of pulling the PTT line to ground to key the rig. Gary suggests bringing the positive keying voltage from his PK-64 out to the pin used for external squelch detect so that both kinds of keying signals are available at the interface.

There are two problems with this approach: 1) very few TNCs offer a positive PTT signal anywhere inside, and 2) the external squelch/carrier detect is important. All TNCs offer the "ground to key" type of PTT signal, so they have this in common. Also, some radios, most notably the new Kantronics packet radio, have better carrier detect circuits than most TNCs, so you don't want to give up the external carrier detect signal to the TNC.

PTT Level Converter

There is a fix for this, and it adheres to the original purpose of a universal interface: to hide the difference between radios. Simply add a PTT level converter to the radio or the radio cable. You can build this converter with only one transistor and two resistors. It is small and it will fit right inside the cable hood, or you can add it to the radio with very little trouble. See the circuit diagram.

The keying transistor is any PNP transistor that will handle the current the rig's keying circuit requires. Better measure it to be sure. The +12V source can be any convenient positive voltage source, as long as it is high enough to key the rig. I picked +12V because it's already there to power most TNCs.

The easiest way to construct this is to actually put it inside the radio where the radio can supply the necessary positive voltage and the circuitry is out of the way.

The Stagnation of Packet Radio

I have been a packet radio enthusiast for seven or eight years now. In fact, I was playing with packet radio before it officially existed. I started experimenting with block transfer of transparent (binary) data shortly after the FCC permitted the transmission of ASCII data. So I guess that I qualify as the packet radio equivalent of an old-timer. This may mean nothing, but I hope that you will continue reading and at least pretend that I know what I am talking about (hi hi). Here it comes:

Amateur packet radio in the United States and most of the world has reached a point of stagnation. If you love packet radio as much as I do, this is cause for significant concern.

Let us look at it historically. The first real TNCs were the "Vancouver Board." I saw one of these things long ago. At that time the protocol was not AX.25 and your parameters were burned into a PROM rather than being changeable. You had to scrounge the parts to populate the board, and beg, borrow, or steal a Bell 202 modem. Needless to say, it was not a turnkey operation, but if you were interested enough, you bit the bullet and built one.

Then along came the Tucson Amateur Packet Radio Corporation (TAPR). TAPR gave us a kit that almost any ham could build. They called it a TNC, and later it became known as the TNC-1. But the TNC-1 was only slightly better than the old Vancouver board. Yes, you could change the parameters and enter your callsign, but it still ran at 1200 bauds and used a Bell 202 compatible modem.

Next, AEA came along. AEA legitimized packet radio by turning the TNC-1 into a product and selling it through the traditional amateur radio distributor chain. Technically, it was still a glorified Vancouver board.

About that time things began to happen on the application front. I cobbled together a RTTY-to-packet gateway. (I lived in the Seattle/Tacoma area where VHF RTTY was a well-established art; where the RTTY enthusiasts were also the packet enthusiasts.) W0RLI came out with his packet BBS for the Xerox 820. It worked, and we had electronic mail.

We also wanted to communicate beyond our own neighborhoods. To that end we began installing digipeaters on mountain tops. In the Pacific Northwest we planned a chain of digipeaters that would connect from Portland, Oregon, to Vancouver, B.C. That was when we discovered that mountain-top digipeaters don't work so well.

TAPR came out with the TNC-2. This really started the ball rolling. The TNC-2 clone manufacturers got on the ball and the price for a TNC dropped to where you could buy one for a little over $100. This started the mass "packet revolution." On the technical side, the TNC-2 was just a smaller and cheaper TNC-1, which means that it still wasn't much removed from the old Vancouver board.

What Isn't Happening

I could go on about PCs, better bulletin board programs, NET-ROM, and the like, but I think that you are beginning to get the picture. In most of the world, amateur packet radio has remained relatively unchanged since its inception. We still do keyboard-to-keyboard chats and exchange electronic mail via bulletin board at 1200 baud. Ho hum. I can do that better on a landline, with a modem, and not need a radio or an amateur license. Perhaps we should take note that most of the discussion of packet radio takes place on CompuServe or on the Internet.

Now comes the serious part. This lack of progress has begun to lead to a packet radio "brain drain." The people who did much of the original work have begun to leave packet radio for other endeavors. A few months ago, at a dinner meeting with several technically-minded "doers" (hams who actually create new packet technology), the discussion turned to who was doing what. Dan Frank W9NK, author of the public domain NET-ROM code used in the KA9Q Net package, said that he was tired of doing the work and never perceiving any change. He said that he took his station off the air, and he was going to do other things until a "real" packet radio network appeared.

This is happening elsewhere in packet radio, too. In the bay area several of the hams who create new technology have decided to go off on a commercial venture and generally abandon amateur packet radio. Their reasons? "Hey, nobody really cares anyway, so why should we beat our heads against a brick wall? At least commercially we get paid for what were giving away for free."

Even I am not immune. All of my packet radio operation today is spent gathering material for this column. I find that I would rather put in an extra hour at work (computer-networking related) and not on packet radio. Why? I am quite frankly bored with sending mail through my local BBS when there aren't many other technical people like myself to talk to anymore, at least not on packet radio.

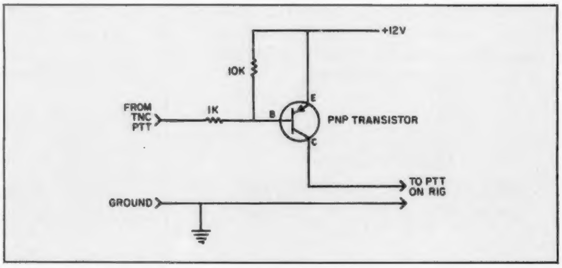
Lest I sound like sour grapes I must add that much of what I know about computer networking has come as a result of my packet activity. The company that I am now working for pays me what I consider to be a substantial salary for my networking knowledge—knowledge that was mostly garnered from building and maintaining the amateur TCP/IP-based packet radio network in Washington, D.C.

OK, things are bad here but what about the rest of the world? Well, Japanese hams seem to be doing new and interesting things. They have real networking, dirt-cheap 9600 bit-per-second modems that work with ordinary radios, radio-based FAX, and digital image transfer. They are experimenting with higher speeds and higher frequencies. More software is coming to the US from Japan and a few places in Europe than is flowing in the other direction. It looks like we are going to lose the technical lead even in our hobby.

What is the Answer?

What can we do to turn the tide? For once I don't think I have an answer. Perhaps it is simply a function of the general malaise that seems to have a grip on amateur radio in the United States. I think that perhaps this stagnation in the most promising and dynamic aspect of amateur radio is simply a sign that amateur radio in the US is dying. Maybe we *should* have our more useful frequencies put to better use. Sure, we are nice to have around after the odd earthquake or hurricane, but is that sufficient justification for tying up lots of valuable spectrum?

This column is likely to be the most controversial I have written. I suspect I will get a large ration of hate mail accusing me of wanting to destroy amateur radio. I will tell you right now that this is not the case. On the other hand, I think someone needs to say that we have a problem we need to deal with. Ignoring it won't make it go away, and neither will lawsuits and lobbying the FCC and Congress. For amateur radio and amateur packet radio to get back on the ball and begin growing, it will take the work of thousands of active and interested hams, not just the League or a few activists. Will you be one of them?



This PTT level converter requires only one transistor and two resistors, and it's small enough to fit inside the cable hood.

Dx

Hams Around the World

Bob Winn W5KNE
c/o QRZ DX
PO Box 832205
Richardson TX 75083

3Y0B DXpedition Postponed

As I write this month's column during mid-January, the Club Bouvet (3Y5X) DXpedition to Bouvet Island has gone QRT. The operators reportedly departed the island on January 14 after more than 40,000 contacts and a two-week operation plagued by an unusual amount of malicious interference. Bear with me, and I'll get to that shortly.

In the January DX column, the League of Indianapolis DXers' DXpedition to Bouvet (3Y0B) was featured, but just a few days before Christmas, Mike W9SU, the expedition director, announced that the DXpedition had been "...postponed indefinitely and perhaps permanently." During late 1989 the 3Y0B group had decided to team up with another group of operators and include operations from other sub-Antarctic islands, such as the South Sandwich Islands and possibly South Georgia. Unfortunately, the vessel contracted for the trip to Bouvet wasn't available long enough to include trips to the other islands, and the search for an alternate vessel with adequate capacity was unsuccessful. The rumor is that this group will try again during late 1990.

DX Policemen versus Lids

The Club Bouvet DXpedition (3Y5X) to Bouvet Island should have been, under normal circumstances, one of the great DX events of the decade. Unfortunately, it turned into a battle between the DX policemen and the lids. 3Y5X's transmit frequency, especially the 20 meter SSB frequency, was turned into a battleground. Deliberate interference, profanity, insults, shouting matches between DXers in the US and other countries, and generally very rude behavior, made it difficult for many DXers to even hear 3Y5X. The mess on the SSB frequencies was probably the worst, but the CW frequencies had their share of mayhem as well. The bogus 3Y5X who insisted on sharing the frequency with the real 3Y5X did nothing but aggravate the situation. One reader gave up the hunt in extreme disgust over "...the shenanigans of the lids, the cops and the ops!...and the Slims."

> ***"The DX operator should periodically state where he or she is listening and refrain from transmitting on the DX station's frequency."***

We have had our share of deliberate interference, etc., with DXpeditions before, but not with this severity. Many DXers were already frustrated when 3Y5X came on the air a few days late due to bad weather conditions. The size of the ensuing pile-ups and the amount of spectrum covered by the pile-ups did nothing but aggravate the situation. The self-appointed DX policemen became agitated with everyone who transmitted on the wrong VFO and ended up on 3Y5X's transmit frequency.

We Don't Need It!

Not content with saying "up" or "wrong VFO," the policemen resorted to insults, then more often than not the admonished DXers responded in kind and the frequency turned to bedlam. Long hours of calling 3Y5X with no results led to frustration and in some cases complaints on 3Y5X's frequency, which in turn brought retaliation from the policemen.

We as DXers don't need this kind of frustration, and certainly not the bedlam experienced on 3Y5X's transmit frequencies. This is a great hobby, not a torture session. What can we do to prevent this unpleasantness from happening again, with other DXpeditions? We don't need policemen; the DX operator can police his own frequency. The DX operator should periodically state where he or she is listening and refrain from transmitting on the DX station's frequency.

If you get upset in a pile-up, take out your frustrations elsewhere, but not on the air. Most important, we must police ourselves, clean up our operating practices, and be serious about our hobby—working DX.

Pile-up Techniques

Apart from those super stations that can produce dominant signals, most DXers must stalk rare DX in much the same way a hunter stalks his prey. Locating DX has become a simpler task in this era of DX spotting nets on VHF and packet DX reporting networks, but once the DX station is found, the average DXer must often use every technique available to get the DX station's attention and work it.

The most important technique is listening. Listen, listen, listen. Listen very carefully to what the DX station is doing. Each time a station is worked in the pile-up, listen to the pile-up and determine the station's frequency. Is the DX operator working stations a little higher in frequency with each contact? Lower? Or does he stay on the same frequency for 5 or 6 contacts?

Listen and learn what the DX station is doing, then based on the station's pattern, make your transmission on the frequency where you think he or she will listen next.

Also make note of how quickly the DX station works stations in the pile-up. If the DX station is working stations very quickly, send your callsign only once, perhaps twice, then listen again. *(Regarding pile-ups and proper DX operation, see also the December 1989 "Never Say Die," page 82.—Eds)* These are only a few of the many techniques for working stations in a pile-up. Listen and you'll discover many more. 73

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#5 ROSE	Designed to work with the ROSE networking software for the TNC2
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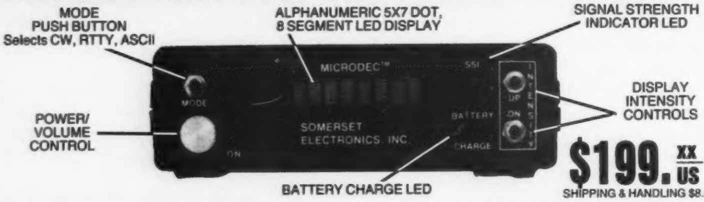

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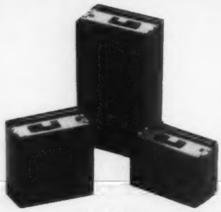

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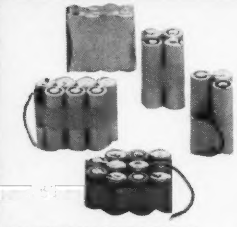

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They're Up!

After numerous delays and rescheduling, the Microsats and new UoSATs are in orbit. At 0135 UTC on January 22nd, an Ariane 4 rocket lifted from the jungles of French Guiana carrying seven satellites into space. SIX of them were amateur radio satellites.

The main payload, SPOT-2, the French imaging satellite, was released soon after the third-stage burn was completed. The two UoSATs from the University of Surrey were next, followed by the four Microsats. Hams around the world breathed a sigh of relief as they monitored the launch via satellite TV or the AMSAT Launch Information Net Service (ALINS).

The ALINS system used a telephone bridge to connect net control operators. These stations then rebroadcast the launch on HF and VHF, and through OSCARs 10 and 13. Anyone who wanted to hear the launch information could find a copyable source with ease.

On the first orbit following launch, the Argentine ground control station commanded LUSAT to activate the CW telemetry beacon on 437.125 MHz. Stations in the States listening for signs of life from the Microsats were greeted with very strong CW signals when the satellite came into view.

Next, N4HY in Princeton, New Jersey, attempted to activate the packet telemetry systems on the new hamsats. The chore proved to be more difficult than expected. System initialization did not take place on the first pass over North America, but by the time you read this, the Microsats should be available for use. For those with two meter packet stations, DOVE can be heard on 145.825 MHz. Standard FM AX.25 packet telemetry can be monitored with any antenna when the satellite is in view.

Check the Sunday AMSAT Net on 14.282 MHz at 1900 UTC for updates. Complete news and progress reports are also available on packet bulletin boards and via ARRL announcements. Microsat and UoSAT data can be found in the May 1989 issue of *73*. Look for "The AMSAT-NA Microsats" by Courtney Duncan N5BF and "Experimental OSCARs" by Jeff Ward G0/K8KA.

Table 1. Listing of CODE.IN for RS10 DE WA5ZIB AR

```
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 00 01 01 01 00
01 00 00 00 01 00 01 00 01 00 00 00 01 00 01 01 01 00 01 01 01 00
01 01 01 00 01 01 01 00 00 00 01 01 01 00 01 01 01 00 01 01 01 00
01 01 01 00 01 01 01 00 00 00 00 00 01 01 01 00 01 00 01 00 00 00
01 00 00 00 00 00 01 00 01 01 01 00 01 01 01 00 00 00 01 00 01 01
01 00 00 00 01 00 01 00 01 00 01 00 01 00 00 00 01 01 01 00 01 01
01 00 01 00 01 00 00 00 01 00 01 00 00 00 01 01 01 00 01 00 01 00
01 00 00 00 00 00 01 00 01 01 01 00 01 00 01 01 01 00 01 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
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00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 FF FF FF FF FF FF FF FF
FF FF FF FF FF FF FF FF
```

Table 2. Listing of BINCON.BAS

```
  1 REM 'BINCON.BAS' VER 1.0 15JAN90 GW-BASIC
  3 REM BINARY CONVERTER PROGRAM FOR EPROM
    BURNERS
  5 REM INPUT FILE MUST BE HEX CAPS IN ASCII FORMAT
  7 REM INPUT FILE SHOULD BE NAMED 'CODE.IN'
 10 OPEN "CODE.IN" FOR INPUT AS 1
 20 OPEN "EPROM.OUT" FOR OUTPUT AS 2
 30 IF EOF(1) THEN 120
 40 X$=INPUT$(1,1)
 50 IF (X$=CHR$(32) OR X$=CHR$(10) OR X$=CHR$(13))
    THEN 30
 60 L=ASC(X$)-48:IF L>9 THEN L=L-7
 70 X$=INPUT$(1,1)
 80 R=ASC(X$)-48:IF R>9 THEN R=R-7
 90 PRINT#2,CHR$(L*16+R);
100 PRINT L,R
110 GOTO 30
120 CLOSE
130 END
```

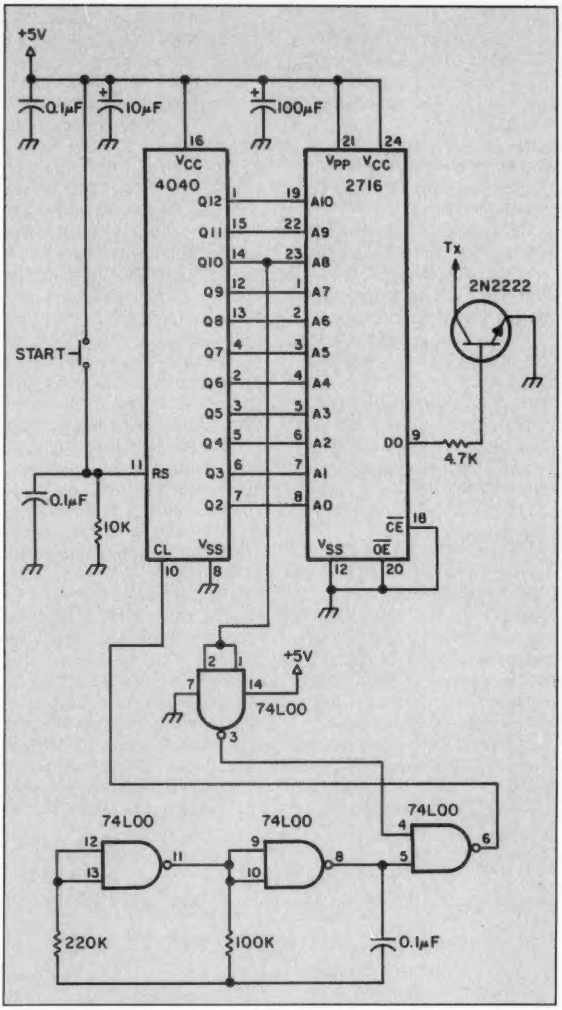

Figure 1. Robot ID Keyer from VK3ZOT. Note: The rectangular boxes are resistors.

Robot Chasing

With hamsat news dominated by Microsats, the Phase 4 geostationary program and the high-orbit satellites, it has been easy to overlook the significance and usefulness of the low-flying Soviet RS satellites.

Most satellite enthusiasts got their start by listening to amateur satellite signals on ten meters. The first hamsat to provide a communications transponder with a ten meter downlink was AMSAT OSCAR 6 launched in 1972. The 145 MHz uplink paired with the 29 MHz downlink became known as Mode "A".

The RS series has continued with Mode "A" as its most common transponder configuration. Today RS-10 can provide newcomers with satellite communications for a minimum investment. The article "Poor Boy Satellite Station" by Allan Fox N5LKJ in the December 1989 issue of *73* should inspire many to try ham radio's repeaters in the sky.

The ROBOT

The ROBOT, or autotransponder, has been a feature of RS satellites since RS-6. For RS-10 the ROBOT can be heard calling CQ on 29.402 MHz. While calling, it announces the uplink frequency it will monitor. For Mode A this is 145.820 MHz.

To call the ROBOT, first center your uplink carrier until it is a steady tone on the ROBOT's downlink. Call the ROBOT at a CW speed close to the speed that you hear. An example sequence would be RS10 DE WA5ZIB AR (where AR is a continuous di-da-di-da-di with no spaces).

The autotransponder will send a message including your callsign and a QSO serial number. Copy the number and other information. When requesting a QSL from Box 88, Moscow, USSR, be sure to include the serial number along with the usual date, time and frequency information.

ROBOT Caller

Newcomers to the ROBOT encounter two problems: If their CW is not perfect, the ROBOT will not respond, or if they use a computer system or any device employing a microprocessor to send perfect code, there may be excessive noise in the ten meter receiver.

Figure 1 shows a solution to this problem. This simple-to-build, three-IC circuit is from Tony VK3ZOT in Montrose, Australia. Tony advises that Dave VK3YMP uses a similar device in his 23cm beacon in Melbourne.

The three ICs needed are a 74L00 low-power quad NAND gate, a CMOS 4040 12-bit binary counter and a 2716 2K x 8 EPROM. If you can't locate a 74L00, a 74HC00 or 74HCT00 will do fine. Chips like the 7400, 74S00 or 74LS00 will not work without circuit modifications. Almost any 2K x 8 EPROM will function in the circuit as long as it has the same pin-out as a 2716 and will run off a single 5 VDC source.

Operation is very simple. The 74L00 acts as a clock for the 4040 as well as a gate for the keyer clock. When pins one and two of the 74L00 are taken high, the keyer stops. The 4040 provides a ripple-counting function to sequentially change the EPROM address lines to read a CW message previously programmed in the 2716 EPROM.

Only one output line from the EPROM is used: D0. It feeds the base of a 2N2222 transistor. The collector of the transistor is connected to the CW key line of the two meter transmitter. When the start button is pressed the message is sent in perfect CW without the use of an RF-noisy computer.

Only a few hundred bytes of the EPROM are needed for the short message to call the ROBOT. Since EPROM programmers are easily available, it is more convenient to use the 2716 than hard-wired diode-matrix systems.

To get the message into the EPROM, first make a file named CODE.IN on a PC-compatible computer, using a word processing program or other means to create ASCII text. Table 1 shows an example. The first line is all zeros to allow a pause before the message begins. Each "dit" is noted as "01". A "dah" is "01 01 01". A space between letters is "00 00 00", and a space between words is "00 00 00 00 00". The "FF" code at the end will provide a key-down condition when the message is over. If the ROBOT gets the message, it will disable its receiver and the carrier will not be heard on the downlink while the ROBOT is acknowledging the call.

If it did not receive the CW correctly due to QRM, fading or other loss of signal then the carrier can be realigned with the uplink passband center (only a few KHz wide) for another try.

The short GW-BASIC program in Table 2 will convert the ASCII information in CODE.IN to a binary file suitable for EPROM programmers. It is very easy to make mistakes during the process of creating your own CODE.IN file. Before going to the trouble to prepare an EPROM for "burning-in", check the code in the resultant program EPROM.OUT for accuracy.

Most binary files produce garbage on the screen when they are displayed using the TYPE command. EPROM.OUT, when loaded only with ones and zeros, is an exception. The binary zeros will show up as blank spaces (the NUL or Null character) while ones represent the control code "SOH" (start of heading) which appears on the screen as a "happy face." The CW message will be displayed as a sequence of happy faces separated by spaces. Your work can be checked very quickly.

After burning in the EPROM, you can do the final checkout of the project by listening to the rig's sidetone oscillator with the ROBOT CALLER attached to the CW key line and a 5 VDC supply. The speed of the keyer seems to be ideal for the ROBOT, and using an EPROM makes it very easy to reprogram for operation with the next RS satellites, RS-12/13 scheduled for launch this year. Check the September 1989 "Hamsats" column for details and frequencies for RS-12/13. Good ROBOT hunting!

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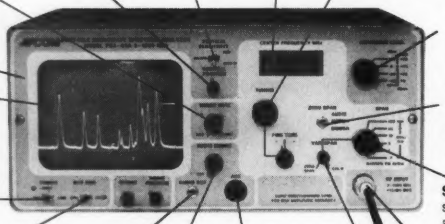

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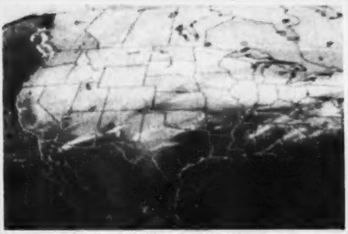

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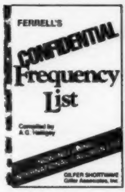

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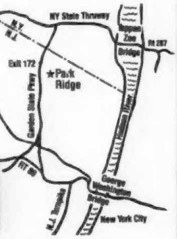

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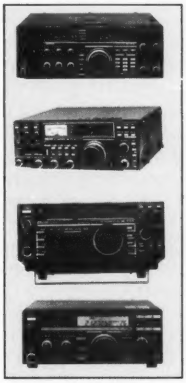

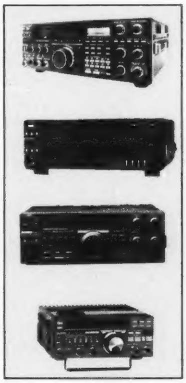

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RDFing for QRM

Unlike 40 years ago, the FCC no longer has the budget and the mandate to scan the spectrum looking for violations in the amateur radio service. As I stated last month, it is more important than ever for us to live up to our reputation for being self-policing. Whenever possible, we must seek to solve our own cases of careless and malicious interference without FCC intervention.

When peer pressure doesn't work, we can serve as extra eyes and ears for the FCC in the Amateur Auxiliary, gathering evidence for eventual prosecution. By adding radio direction finding (RDF) capability to your HF mobile installation, you can track down interference problems in your area.

Besides jammers, you can locate QRN sources such as noisy power lines and cable TV leakage. You don't need fancy, expensive equipment. A simple loop is all it takes for accurate ground-wave RDFing.

Build the Homer

I can hear some veteran VHF T-hunters scoffing at the idea of hunting jammers with an old-fashioned loop. It's true that loops are not competitive with beams and dopplers on 2 meter FM T-hunts. But on 15 meters, dopplers and beams are out of the question for mobiles.

There are more sophisticated mobile RDF setups for the HF bands, but how many hams are willing to spend the time and dollars to implement them just to hunt an occasional jammer? The HF Homer, on the other hand, is so simple that just about any HF mobile enthusiast can build and use it. When interference comes on, it's too late to start the project, so get the parts together and start building now.

A Combat-Proven Design

I adapted the HF Homer from a design used by the US Army in the fifties. The hand-held AT-340/PRC RDF Homing Antenna covered 20 to 39 MHz and worked with field portable receivers that were predecessors of the "manpacks" of today. Surplus AT-340s are hard to find now because they were snapped up by hams back when 10 meter foxhunts were popular.

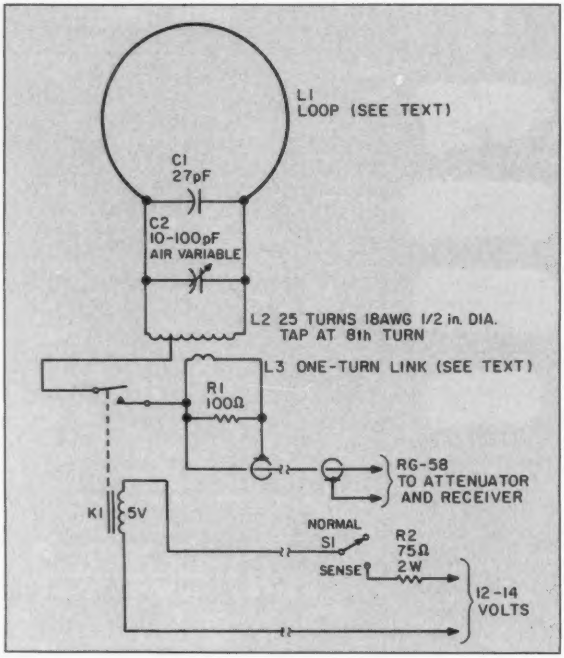

Figure 1. Schematic diagram of the HF Homer. S1 and R2 are inside the vehicle. All other parts are in the mast-mounted box.

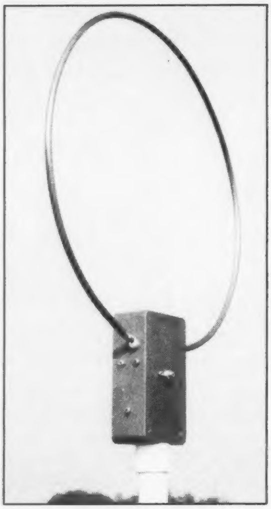

Photo A. The HF Homer uses soft copper tubing securely bolted to a plastic box, mounted on a PVC pipe mast.

The HF Homer gives the same performance and ease of use as the army loop, but it has a lower frequency range (18 to 30 MHz) and it's mast-mounted for mobile hunting. The loop, shown in Photo A, is 13½" in diameter, on a mast two feet above the roof of the van to minimize proximity effects. The SENSE mode was selected by a toggle switch on the AT-340 case, but in my design, it is relay-activated from inside the vehicle.

The HF Homer is a "work-alike" to the VHF-FM Handy Tracker (see "Homing In" for September 1989). The principle of operation is different, but hunting procedures are quite similar. You get the sharpest bearing indications in the NORMAL mode, which has a figure-8 antenna pattern.

Two broad-response peaks and two very sharp nulls are indicated on the receiver's S-meter as you rotate the mast of the antenna 360 degrees.

Peak response occurs when the incoming signal is in the plane of the loop, and the nulls occur when the signal is "through the loop." Usually, you'll use the nulls instead of the peaks to determine the line of bearing. This gives two possible directions for the incoming signal, 180 degrees apart.

Closing S1 picks up relay K1 and puts the HF Homer in the SENSE mode, changing the antenna response pattern to favor one of the two peaks.

The purpose of the SENSE mode is to resolve the 180 degree ambiguity of the NORMAL mode's peaks and nulls. Once you have practiced a bit, you can take a bearing much faster than I can explain how to do it.

If you have experimented with HF loops in the past, you'll notice some differences between the HF Homer and typical ham designs. This is not a shielded loop. Many loops have a shield to eliminate the "antenna effect" and couple only to the magnetic component of the incoming signal. Such designs require a separate vertical sense antenna to resolve the 180 degree ambiguity.

The HF Homer takes advantage of the antenna effect to resolve the ambiguity in the SENSE mode by properly combining the electrical and magnetic field pickup. In the NORMAL mode, the antenna effect is canceled by properly configuring the L2/L3 coupling coils. This eliminates the shield and the separate whip, simplifying construction.

To the Plumbing Store

There are no exotic parts in the HF Homer. You should be able to assemble it in an evening or two. I made the loop from ¼" O.D. soft copper tubing. You'll find it in the plumbing section of your local do-it-yourself store, intended for supplying water to refrigerator ice-makers. It comes in a coil, so you won't have to form it into a circle. Cut the tubing to 39".

Use solder lugs and 10-32 hardware to mount the tubing on the 4¾" x 2½" x 1½" plastic case (Radio Shack 270-222). I soldered the tubing and lugs directly to the

Continued on page 65

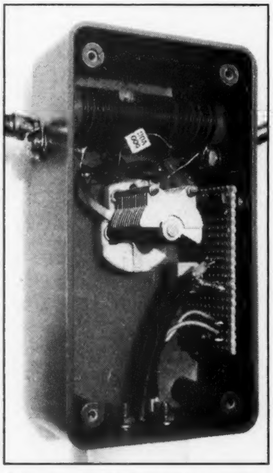

Photo B. Inside the HF Homer enclosure. Stator terminals of C1 are clipped off to make it fit in the box.

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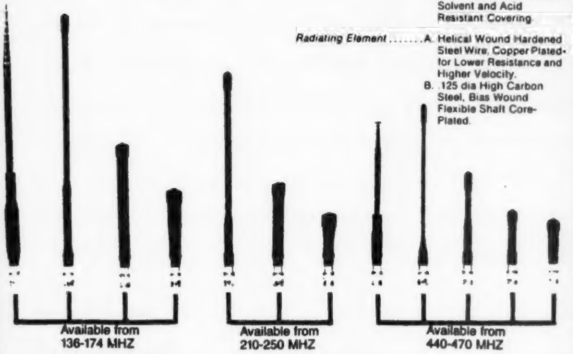
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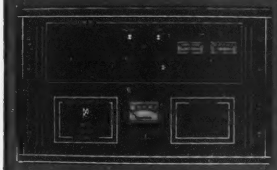

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6 Meter Operation

Because of a tight work schedule, I missed some 6 meter openings, but I was able to listen to others on my recorder. Hope you made a lot of contacts!

To improve my 6 meter station, I'm currently building a high power amplifier. I've obtained several used 4CS250SR conduction-cooled tubes, similar to 4CX250 (force-air cooled) ceramic tubes, for the project. Due to a hearing loss acquired in the service, I can't operate near low-frequency noise sources, such as blower motors, so the silent conduction-cooled tubes (with heat sink transfer) are quite a premium item to me.

Along with regular high voltage safety precautions, conduction-cooled tubes require special care.

Safety with Amplifier Power Tubes

Like high power RF transistor amplifiers, the tube requires a large aluminum heat sink. The thermal link of a conduction tube is the counterpart to the cooling fins on forced-air transmitting tubes. This ceramic link (insulator) used to remove heat from the conduction-cooled tube is made of beryllium oxide (BeO), a rather nasty, toxic substance. There is no problem in normal handling and use, but I recommend that you store ceramic tubes in a separate container to prevent cracking the ceramic (BeO) material.

Varian states in its literature that the BeO thermal link may be brazed to the anode section of the power tube, or it may be a separate accessory. Do not perform any operation such as grinding, grit blasting, and acid cleaning on any BeO ceramic tube which might produce dust or fumes. BERYLLIUM OXIDE DUST OR FUMES ARE HIGHLY TOXIC AND BREATHING THEM CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH.

Varian goes on to state that because labels may become obliterated or removed, especially on used components, you should contact your tube supplier before performing any work which might affect the thermal link (BeO). Not all ceramic components of power tubes are made from beryllium oxide, but for safety's sake, treat them as if they were.

For further information, I suggest the Varian Eimac Division's "Quick Reference Catalog" on power grid tubes and "Care and Feeding of Power Grid Tubes." You can find additional information in *The Radio Handbook* by Bill Orr W6SAI and *The ARRL Handbook.*

MMIC Amplifiers

This month's technical presentation on MMIC (Microwave Modules Integrated Circuit) amplifiers includes several examples of basic gain blocks for amateur use. These tiny monolithic wideband amplifiers are very inexpensive, operate to over 2 GHz, and provide high gain. They come in a plastic package 0.085" in diameter. In a quantity of 25, they cost less than a dollar each.

The input and output impedance of the MMIC amplifiers are 50 ohms. This differs from a transistor amplifier with variable impedance that requires impedance matching circuits on both the input and output. The MMIC amplifier does not require impedance matching circuits. In many cases the devices are connected coaxially in a circuit with minimum components forming equal, if not better, amplifiers than discrete construction. Simple power supply bypassing, DC isolation and good ground returns, reward you with a simple amplifier.

Not only are they easy to use, they are also readily obtainable from Mini Circuits in a Designer's Kit (DAK-2). Seven different MMIC devices come in this kit of 35 amplifiers and are available for $59.95. A good deal, allowing lots of experimentation for little cost. Quite a few amateurs have commented to me that they bought the kit instead of ordering separate amplifiers for projects. These devices are also available from Avantek. Part numbers differ, but I am informed that they are essentially the same device. See the Table for details.

> **"Not all ceramic components of power tubes are made from beryllium oxide, but for safety's sake, treat them as if they were."**

MMIC Circuitry

Use of the MMIC amplifiers is quite simple requiring only an input and output coupling capacitor. DC voltage is supplied to the device with a series resistor and RF choke for bypassing and tied directly to the output of the device. The choke and current limiting resistor should be bypassed to ground with short leads. This improves gain and stage stability, helping to prevent unwanted oscillations. Additional bypass or select RFCs can improve operation at the upper frequency limits of the devices. In contrast, spurious emissions will plague you with poor supply bypassing. See the amplifier test circuit in Figure 1.

I have used these devices in so many different applications I could not keep track of them. The latest use was in a transceiver for 2300 MHz. The PC board layout was published in the North Texas Microwave Society's newsletter Feedpoint. I made a test board as soon as I saw the article. This unit uses two MAR-6 devices each in the receive and transmit amplifiers. The two amplifiers each feed one leg of a combiner which ties to a common filter and mixer, using a 2 meter HT for the IF system.

While working above their rated frequency of 2 GHz, the devices reduce gain performance, giving about 7 dB per device at 2300 MHz. What makes this PC board so exciting is that it doesn't require tuning or circuit adjustment, just capacitive input and output coupling with good DC feedthrough bypassing. (I will try to get a copy of the artwork for this project and include it in a later column.) See Figure 2 for the schematic.

Another application for MMIC devices is in oscillator multipliers. Overdriving the input of the MMIC amplifier produces an output rich in harmonics which can be bandpass-filtered, eliminating the unwanted products.

You can then use another MMIC to build up the desired harmonic power in oscillator multiplier chains. These devices will catch on in amateur applications for some time to come because of their ease in use and their varied applications.

Mailbox Comments

Henry of Garden Valley, California, is looking for information on how to construct microstripline circuits and other inexpensive test equipment for our microwave bands. Frank N6PVO is looking for a good text on microwave basics. Jay N1GBS is considering microwave for transmission of

Continued on p. 65

Specifications for Mini Circuits

Model	Freq MHz	Gain dB 100 MHz	Gain dB 1000 MHz	Gain dB 2000 MHz	Max PWR dBm	NF dB	Price Ea.	Color DOT
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MAR-3	DC-2000	13.0	12.5	10.5	+8	6.0	1.70	ORANGE
MAR-4	DC-1000	8.2	8.0	—	+11	7.0	1.90	YELLOW
MAR-6	DC-2000	20.0	16.0	11.0	0	2.8	1.29	WHITE
MAR-7	DC-2000	13.5	12.5	10.5	+3	5.0	1.90	VIOLET
MAR-8	DC-1000	33.0	23.0	—	+10	3.5	2.20	BLUE

Prices are for quantities of 25 from Mini Circuits. Note that the MAR-8 is the only amplifier not unconditionally stable. It requires special matching to your test circuit. Mini Circuits, PO Box 350166, Brooklyn NY 11235-0003. Avantek, 101 Renner Rd., Woodcreek Plaza Ste 180, Richardson TX 75080. (214) 437-5694.

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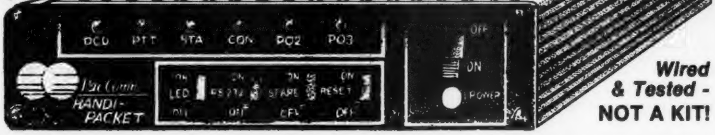

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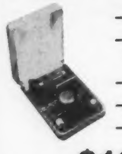

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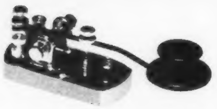

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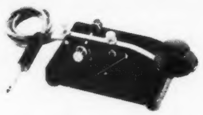

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Homing In

Continued from page 60

bolts, to keep them from working loose. (Intermittents were a problem with the army's collapsible version.) Solder the bolt and lug to the tubing before fastening it on the box, so you don't melt the plastic.

The mast is ¾" Schedule 40 PVC pipe. The coax and relay control signal leads go down the inside of the pipe. Mount a ¾" slip-type PVC pipe cap to the box as shown in Photo B, using 6-32 hardware. Match-drill the pipe cap and box for the wires.

Bolt a 1" x 2" piece of unclad perfboard in the box to terminate the external leads and to mount K1 and R1. I used a subminiature relay (Radio Shack 275-240) with a 5 volt coil. That allows me to use the unit on foot with a "sniffer" that has a 6 volt battery supply.

R2 drops the voltage when I use the vehicle's electrical system. If you only intend to use the loop in the vehicle, you can substitute the RS 275-241 or another relay with a 12-volt coil, and eliminate R2.

Tuning capacitor C1, shown in the middle of the box in Photo B, must be an air variable type. Small air variables are becoming hard to find. Try your local surplus emporium or electronic swap meet.

Marlin P. Jones Company (PO Box 12685, Lake Park, FL 33403, (407) 844-8764) has a 120 pF part, stock number AV-0091, for $1.75. Measure your capacitor before mounting it, as it might be too long to fit on the side wall of the box.

Wind L2 on a ½" diameter form, with the 25 turns spaced for a coil length of 2". I used rod stock from a local plastics supplier for the form. The tap is 8 turns from the right end. L3 is a length of solid AWG 22 insulated wire formed into a single-turn link over L2. Lightly twist its leads over to K1 on the perfboard. Leave a little slack so the link can be moved along the length of L2.

You will find the exact position of L3 during alignment. In Photo B, the link is over the tenth turn from the left end, held in place with a dab of hot glue. Put yours there for starters.

You can hold the loop out a car window by hand to take bearings, but I don't recommend it. Interaction with the vehicle causes errors and it's hard to get bearings while driving. And imagine the sore muscles and wet, cold fingers you'll get on a rainy night. Make a rotating mount for the mast.

Put a 360 degree compass indicator on the mast for accurate triangulation. Set the pointer to indicate one of the two nulls.

It's hard to tell when you are looking exactly through the loop, so set the mast to indicate 90 or 270 degrees relative to vehicle heading, and visually line up the loop so the plane is exactly to the front and rear. Use bolts or glue at all PVC slip joints so nothing twists.

Besides the loop, you will need a well-shielded receiver and attenuation system, all securely mounted in the vehicle for convenience and safety.

A stable test signal for each band is a great help in alignment. A QRP milliwatt rig is fine, or perhaps you have an old VFO or signal generator. I use a TTL oscillator I built to check crystals for activity. Start the alignment on 15 meters. Be sure the vehicle is in a clear area, away from overhead wires.

First, tune the loop to resonance. With S1 in the NORMAL position (relay open) and the loop plane in the direction of the test signal, tune C2 for maximum S-meter reading. Locate the receiver so that you can see the S-meter when tuning, because you won't be able to find the exact peak by ear. Use your attenuator to knock down the signal if the S-meter reads over S9. Most S-meters are less sensitive to small changes when readings are in the upper scale.

As you rotate the loop in the NORMAL mode, there should be two deep nulls perpendicular to the plane of the loop and exactly 180 degrees apart. One of these nulls should be in the direction of your mast pointer. Repeat this check on 10, 12, and 17 meters.

If the NORMAL mode nulls are not exactly 180 degrees apart or are very shallow, the loop isn't well balanced. Experiment with the location of link L3 on coil L2 for optimum performance on the four bands.

Next, check SENSE mode operation. Close S1 and turn the mast +90 and −90 degrees from the pointer null. One or the other directions should give stronger S-meter readings on the test signal, depending on how you connected L2/L3 leads. Mark the side of the mast to indicate the strongest peak side. Check the SENSE mode on all four bands. You will probably get best front-to-back sense indications on 15 meters, because that band is closest to design center frequency, but indications will be good enough to use on all bands. ■

Continued from p. 62

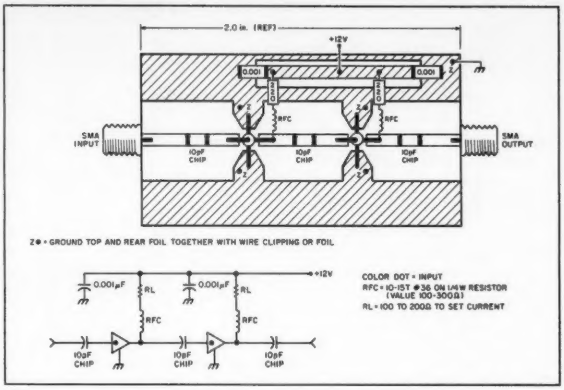


Figure 1. MMIC amplifier test circuits. You can use them as a single-stage amplifier.

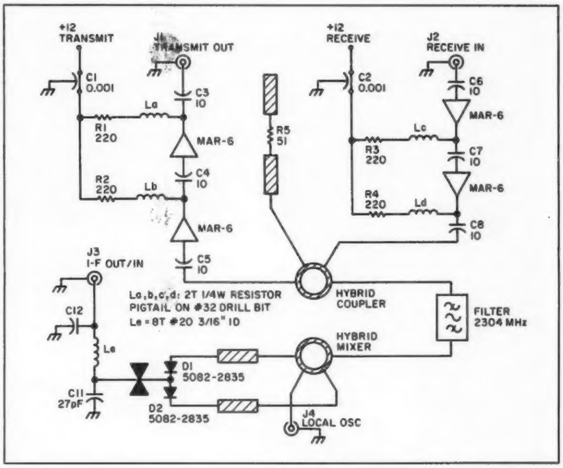


Figure 2. Design by Don Lund WA0IQN, courtesy of Feedpoint, *published by the North Texas Microwave Society, May 1989.*

higher speed packet, and looking for receivers and transmitters to build to achieve this goal. I have received similar requests for simple devices to construct that don't become "deep pocket" projects.

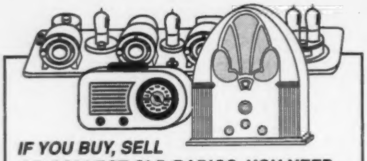
I can think of many projects that would fill the bill, such as my past projects in *73 Magazine* articles on wideband FM systems. These can be adapted for packet, though I haven't gotten into that myself, yet.

Several good references are available. The San Diego Microwave Group has a booklet covering our entry into wideband FM on 10 GHz. The booklet details all the projects you need to construct a station for FM, beacons, SSB operation and associated test equipment. Full schematics and some printed circuit boards are available. Cost is $15 postpaid and is available from me at the above address.

The North Texas Microwave Society's newsletter, *Feedpoint*, is packed full of up-to-date microwave projects and happenings. I always look forward to receiving it. Dues are $12 a year. For information, contact WA5TKU, Wes Atchison, Rt. 4, Box 565, Sanger TX 76266.

Another good reference book I'm very fond of is *The RSGB VHF/UHF Handbook* by G.R. Jessop G6JP. It costs about $35 and covers the full gamut of our VHF/UHF spectrum, including topics on receivers, transmitters, filters, antennas, and test equipment for frequencies from 50 MHz and up. You can buy this book at some large ham radio stores and technical bookstores. Also check *73's* bookshelf at (603) 525-4201.

As always, I'll be glad to answer any questions concerning this or any other amateur related VHF/UHF project. Please send an SASE for prompt reply. 73's, Chuck WB6IGP ■



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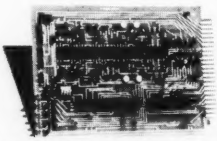

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UG-175	Reducer for RG-58	.20
UG-176	Reducer for RG-59 & MINI 8	.20
UG-21D/U	N Male RG-8, 213, 214, Delta	3.25
UG-21B/U	N Male RG-8, 213, 214, Kings	5.00
9913/PIN	N Male Pin for 9913, 9086, 8214 fits UG-21D/U & UG-21B/U N's	1.50
UG-21D/9913	N Male for RG-8 with 9913 Pin	3.95
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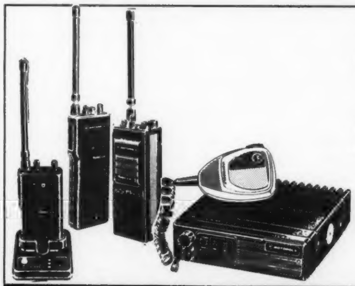

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1102 RG8/U 95% shield low loss foam 11ga	.36
1110 RG8X 95% shield (mini 8)	.17
1130 RG213/U 95% shield mil spec NCV jkt	.39
1140 RG214/U dbl silver shld mil spec	1.85
1705 RG142B/U dbl silver shld, teflon ins	1.50
1310 RG217/U 50 ohm 5000 watt dbl shld	.98
1450 RG174/U 50 ohm .100" od mil spec	.14

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8C1822 2-18ga and 6-22ga	.21/ft
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CONNECTORS-MADE IN USA

NE720 Type N plug for Belden 9913	$3.95
NE723 Type N jack for Belden 9913	4.95
UGC273 BNC-PL259 Adapter-Amphenol	3.00
PL259AM Amphenol PL259	.89
PL259TS PL259 teflon ins/silver plated	1.59
PL258AM Amphenol female-female (barrel)	1.65
UG175/UG176 reducer for RG58/59 (specify)	.22
UG21DS N plug for RG8,213,214 Silver	3.35
UG83B N jack to PL259 adapter, teflon	6.50
UG146A SO239 to N plug adapter, teflon	6.50
UG255 SO239 to BNC plug adapter, Amphenol	3.29
SO239AM UHF chassis mt receptacle,Amphenol	.89
UG88C BNC Plug RG 58,142	1.45

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Number 25 on your Feedback card

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73 Flea Market*, Barter 'n' Buy, costs you peanuts (almost)—comes to 35¢ a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the *Barter 'n' Buy*, Donna DiRusso, Forest Road, Hancock NH 03449 *and get set for the phone calls.*

QSLs TO ORDER. Variety of styles, colors, card stock. W4BPD QSLs, PO Drawer DX, Cordova SC 29039. BNB260

THE DX'ERS MAGAZINE Up-to-date, informative, interesting. Compiled and edited by Gus Browning W4BPD, DXCC Honor Roll Certificate 2–4. Send for *free* sample and subscription information today. PO Drawer DX, Cordova SC 29039. BNB261

AZDEN SERVICE by former factory technician. Fast turnaround. PCS-300 NiCads $36.95. Southern Technologies Amateur Radio, Inc., 10715 SW 190 St. #9, Miami FL 33157. (305) 238–3327. BNB262

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SUPERFAST MORSE CODE SUPEREASY. Subliminal cassette. $10. LEARN MORSE CODE IN 1 HOUR. Amazing new supereasy technique. $10. Both $17. Moneyback guarantee. Free catalog: SASE. Bahr, Dept 73-7, 1196 Citrus, Palmbay FL 32905. BNB531

SB-220/221 OWNERS: 17 detailed mods which include 160–6 meter operation, QSK, +enhanced p.s. 50% rebate for new mods submitted! 9 pages of 3-500Z tech info. $11 postpaid.—Info. SASE, BOB KOZLAREK WA2SQQ, 69 Memorial Place, Elmwood Park NJ 07407. BNB581

YAGI Builders. Tube Traps, Tubing, Clamps and Universal Plate for Boom to Mast or Elements. SASE for List. USA call 800–833–3794 from 1–2 PM EST. Brown Engineering Inc., 5501 SW 25th Court, Hollywood FL 33023. BNB624

12TH ANNUAL TSRAC WHEELING HAMFEST/COMPUTER FAIR, Sunday, May 20, Wheeling Park, 8 AM to 3 PM. WV's largest Hamfest. Dealers welcome, under roof. Free flea market. Family Hamfest: WOMEN FREE, Children 16 under free. Admission $2 in advance—$3 at door. Contact: TSRAC, Box 240, RD 1, Adena OH 43901 (614–546–3930). BNB628

ROSS' $$$$ USED April SPECIALS: KENWOOD TS-930S/WAT $1349.90, TS-140S $679.90, TH-415A $269.90, TS-530S $619.90, ST-2 $78.90, BC-8 $34.90, PB-1 $54.90. ICOM IC-751 $999.90, AT-500 $389.90, IC-2KL $1634.90, IC-45A $179.90, TEN-TEC 263 $159.90, 260 $139.90, 234 99.90, 225 $99.90, 251M $89.90, 252MO $99.90, 252 $89.90, 960 $189.90, 215 $22.90. LOOKING FOR SOMETHING NOT LISTED?? CALL OR WRITE, WE HAVE OVER 220 USED ITEMS in stock. MENTION AD. PRICES CASH, FOB PRESTON. HOURS TUESDAY–FRIDAY 9:00 TO 6:00, 9:00–2:00 P.M. MONDAYS. CLOSED SATURDAY & SUNDAY. ROSS DISTRIBUTING COMPANY, 78 SOUTH STATE, PRESTON ID 83263. (208) 852–0830. BNB654

WRITTEN EXAMS SUPEREASY. Memory aids from psychologist/engineer cut studytime 50%. Novice, Tech, Gen: $7 each. Advanced, Extra: $12 each. Moneyback guarantee. Bahr, Dept 73-7, 1196 Citrus, Palmbay FL 32905. BNB691

ROSS' $$$$ NEW April SPECIALS: TS-140S $755.90, TM-253A $409.90, TS-950SD $3719.90, TM-231A $389.90, TH-41AT $189.99, TH-31BT $209.90, TH-225A $339.90, TH-315A $289.99, TS-940S $1799.90, ICOM IC-900 $458.99, IC-735 $969.90, IC-2SAT $374.90, IC-24AT $539.90, IC-3200A $464.99, IC-228H $419.50, IC-761 $2199.90, IC-781 $4918.99, YAESU FT-747GX $679.90, FT-767GX $1749.90, FT-209RH $276.99, FT-470 $434.90, HEATHKIT SB-1000 $679.90, HW-2-P $329.99, HWS-24-HT $429.90, HD-1250 $119.90, HD-1416 $22.90, HWS-24HT $449.90, AEA PK-232MBX $307.90, PK-88 $119.90, MM-3 $159.90, HAL ST-6000 $599.99, PCI-2000 $369.99, KB-2100 $129.90, CT-2100 $439.90. ALL L.T.O. (LIMITED TIME OFFER) LOOKING FOR SOMETHING NOT LISTED?? CALL OR WRITE. Over 9004 ham-related items in stock for immediate shipment. Mention ad. Prices cash, F.O.B. PRESTON. HOURS TUESDAY–FRIDAY 9:00 TO 6:00, 9:00–2:00 P.M. MONDAYS. CLOSED SATURDAY & SUNDAY. ROSS DISTRIBUTING COMPANY, 78 SOUTH STATE, PRESTON ID 83263. (208) 852–0830. BNB709

HF PACKET IMPROVEMENT Digicom>64 revision "A" circuit now available. Board plugs directly into cassette port or remote mount via cable, both connectors included. Power derived from computer. Uses 7910 chip—no alignment required. Switch allows HF or VHF operation. Order Kit #154 for $49.95 or Assembly #154 for $79.95, both include FREE DISK. Add $3.50 s/h, CA add 6.25% tax. A & A Engineering, 2521 W. La-Palma #K, Anaheim CA 92801. (714) 952–2114. MC or VISA accepted. BNB732

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WANTED: Ham Equipment and other property. The Radio Club of Junior High School 22 NYC, Inc., is a nonprofit organization, granted 501(C)(3) status by the IRS, incorporated with the goal of using the theme of ham radio to further and enhance the education of young people nationwide. Your property donation or financial support would be greatly appreciated and acknowledged with a receipt for your tax deductible contribution. Meet WB2JKJ and the "22 Crew" at Dayton, we will have two tables for "Classroom Net" members to congregate at. Talk-in on 144.30 throughout the Hamvention. Join the "Classroom Net," 7.238 and 21.395 daily. Write us at: PO Box 1052, New York NY 10002. Round the clock Hotline: (516) 674–4072. BNB762

HAMLOG COMPUTER PROGRAM Full features. 18 modules. Auto-logs, 7-band WAS/DXCC. Apple, IBM, CP/M, KAYPRO, TANDY, CR8 $24.95. 73-KA1AWH, PB 2015, Peabody MA 01960. BNB775

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DOSSAT SATELLITE TRACKING PROGRAM $39.95. IBM-PCs/compatibles, graphics and tabular output, realtime and prediction modes, rotor controller support, geosynchronous (Phase IV) tracking. Satellite Software, PO Box 37, Redmond WA 98073. (206) 868–1040. BNB835

MACINTOSH SOFTWARE: Logging, contest, Morse and theory training. ZCo Corporation, PO Box 3720, Nashua NH 03061. (603) 888–7200. FAX (603) 888–8452. BNB874

LOW COST HAM RADIO EQUIPMENT. Send SASE for list. JIM Brady/73, 3037 Audrey Dr., Gastonia NC 28054. BNB890

SURPLUS CATALOG. 72 pages. $2. Surplus, PO Box 276, Alburg VT 05440. BNB891

WANTED: All types of Electron Tubes. Call toll free 1 (800) 421–9397 or 1 (612) 429–9397. C & N Electronics, Harold Bramstedt, 6104 Egg Lake Road, Hugo MN 55038. BNB900

10 MTR FM HYGAIN CB BOARD with instructions $9.95. FM DET KIT $7.00. 40 Channel Switch $5.00. Crystal $5.00. SQ/VOL Pots $2.00/pair. All for $24.95 plus $2.00 S/H: MORNING DISTRIBUTORS, PO BOX 717, HIALEAH FL 33011. (305) 884–8686. BNB902

The 21st Annual B*A*S*H will be held on FRIDAY NIGHT of the Hamvention, April 27th, 1990 at the Conference Center (Madison Room) of the HARA ARENA AND CONFERENCE CENTER, (the same location as the Hamvention), starting at 7 PM. There is no admission charge, and free continuous entertainment. Hot dinner, sandwiches, snacks and beverages are available. Two exciting top awards, and many others. Stay right at HARA when the Hamvention closes on Friday evening and meet your friends and join us for an evening of fun and entertainment. ANNOUNCING!! Weather permitting, there will be a hot air balloon launch on Saturday, April 28, 1990 or Sunday, April 29, 1990 at approximately 6:45 AM conducting aeronautical QSOs. Frequencies to be announced at the B*A*S*H. Special Event QSL cards will be issued. Sponsored by the Miami Valley FM Association, PO Box 263, Dayton OH 45401. BNB909

HAM SOFTWARE IBM/Compatibles 10 disks $26.95. MC/VISA/Discover. N5ABV EAPCO/7, PO Box 14, Keller TX 76248-0014. (817) 498–4242. Order Only 1 (800) 869–7208. BNB911

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DIGITIZER FOR IBM COMPATIBLE PCs 640 by 480 resolution from VCR video camera $85 demonstration disk $3. Codeware, Box 3091, Nashua NH 03061. BNB925

AMIGA, MACINTOSH, ATARI XL/XE/ST Amateur Radio public domain software, $4.00/disk. SASE for catalog. Specify computer! WA4EFH, Box 1646, Orange Park FL 32067-1646. BNB926

OAK CHIP AND CABLE DESCRAMBLER. VE4NC. (204) 687–5185. BNB927

WANTED: McIntosh stereo equipment. Gary Stejskal, 1412 26 St. N.W., Cedar Rapids IA 52405. BNB928

YOUR OWN PESONAL QSL CARD on disk for the C-64. Send your name, address, county, and call along with $5.00 to Pals, PO Box 2, Berwick PA 18603. BNB929

WANTED: HF transceiver for mobile use. QRP OK. J. Buckowski, PO Box 2852, Petaluma CA 94953. BNB930

BATTERY PACK REBUILDING: Don't pitch it—mail it—for FAST—PROFESSIONAL service! Satisfaction guaranteed! ICOM: BP2/BP3 $19.95, BP5 $25.95, BP7/BP8/BP70 $32.95. KENWOOD: PB21 $15.95, PB21H $21.95, PB25/25H/26 $24.95. YAESU FNB9 $19.95, FNB10 $23.95, FNB4/4A $36.95, Ten-Tec $24.95, "U-DO-IT INSERTS" ICOM: BP3 $16.95, BP5 $22.95, BP7/8 $27.50, KENWD: PB21 $12.95, PB24/25/26 $19.95, TEMPO: S1-15/series $22.95, YAESU: FNB4/4A $32.95, FNB10 $18.95, AZDEN: 300 $19.95, "NEW PACKS" ICOM: PB5 $43.95, BP8S $58.95, YAESU: FNB2 $19.95, FNB10S/FNB12 $44.95, SANTEC: 142/1200 $22.95. TELEPHONE / PAGER / COMPUTER / COMMERCIAL PACKS—FREE CATALOG. Add $3 Shipping/order. PA+6%, VISA–M/C add $2. CUNARD, R.D. 6 Box 104, Bedford PA 15522. (814) 623–7000. BNB931

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DEALERS: Your company name and message can contain up to 50 words for as little as $420 yearly (prepaid), or $210 for six months (prepaid). No mention of mail-order business please. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April '89 issue must be in our hands by February 1st. Mail to *73 Amateur Radio*, Box 278, Forest Road, Hancock, NH 03449.

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Kenwood Corporation Service

A tour through the service department.

by Gordon West WB6NOA

When you deal with Kenwood USA Corporation, you are dealing with one *big* company. As Joel Berger WD6BQD, Kenwood's National Service Manager, took me on a scheduled tour of the service department, I noticed the professional manner in which they greet customers bringing equipment in for repair. However, as with ICOM, Yaesu, and other large manufacturers of amateur gear, the fact that you brought it in doesn't mean it's going to get fixed while you wait.

Craig Martin KR6T, Kenwood's Customer Service Manager, offers *73 Magazine* readers the following tips on securing fast Kenwood service for 1990: "Whenever someone calls our service department, they will be greeted by a message providing them with options so that they will be able to contact the appropriate department. Should the customer wish to talk with a technician, he should select the technical department. Customers can be freely transferred from service to parts to sales, etc. Please also note that we operate on Pacific Standard or Pacific Daylight time. Our hours are from 08:30 through 17:00 Monday to Friday, excluding holidays."

Touring Kenwood's Service Facility

In addition to ham radios, the company services business radios, audio equipment, car stereos, and marine equipment, in separate sections. About 10% of the personnel are Japanese; most are American. Surprisingly, everyone is trained to work on many types of rigs. They're all knowledgeable, but there's always someone who's a real specialist on a particular type of equipment.

Kenwood has 35,000 parts to support the needs of the service department. The parts go back for up to 10 years, so even old Kenwood sets can be repaired, though tubes are a problem. Quality 6146B tubes are no longer available in the US, and Kenwood 510 and 511 sets are still operating. If you have one of these older sets, stock up now on the tubes. If you have an early Kenwood handheld, let a local battery store rebuild your NiCd pack. This will save you time and money in the long run. There's nothing magic about older Kenwood battery packs. Be sure to bring in the old pack so the battery rebuilder can see where the wires hook up.

Photo A. Kenwood's top service men: Craig Martin KR6T, the Customer Service Manager (left), and Joel Berger WD6BQD, the National Service Manager (right).

Photo B. A Kenwood test bench with ultra-sophisticated test equipment for hard-to-trace malfunctions.

Photo C. Maria KC6ABM (Anti Ballistic Missile) at the Kenwood employees' ham club station.

Kenwood was quick to point out their team approach to fixing equipment properly and quickly. Berger: "It's your hobby, but it's our business." The Kenwood amateur radio repair technicians, nine total, enjoy providing good service for your equipment. And they are hams, too.

One of Kenwood's enthusiastic employees, Maria KC6ABM, set up a successful amateur radio class for visiting Japanese hams who wanted to get their US licenses. Maria is regularly on the air from Kenwood's deluxe base station console that's open to all hams wanting to do a little rag-chewing during lunch (see Photo C).

All repair records are kept on computer. Berger: "This is usually detailed on the work order included with the fixed set." As a ham, I like to see exactly what they did to fix it.

It seems a shame that quick, emergency repairs are not available. Some hams, getting ready for a big trip, might pay up to three times the normal repair rate to get their sets fixed quickly, but none of the manufacturers offer quick fixes at higher rates. However, equipment that comes in for the same problem a second time is pushed ahead of the line. Also, Kenwood does provide priority on returns at no additional charge.

Common Service Problems

These vary from unit to unit, but a brief breakdown might be:

- Handhelds—Dropped unit/improper charger
- VHF Mobiles—Reverse polarity/front-end overload
- HF Mobiles—Reverse polarity/salt water damage/front-end overload
- HF Base Units—Front-end overload/lightning strike/bad finals (from high SWR or trying to run too much power)

In addition, problems may be due to improper connections, such as using a wrong jack.

Out-of-Band Procedures

Martin: "We will repair all Kenwood radios regardless of the modifications as long as you provide a description of what the modification does, how it is controlled, and how it was accomplished. We will not fix your modification! If it is determined that the problem is caused by the modification, it might be necessary for us to disconnect the modification in order to complete the repair. We will not attempt to reconnect it even if we have the instructions! We will also not fix transmit problems outside of the normal ham bands. This includes MARS, CAP, and especially CB modifications."

Sending in Your Unit

According to Martin, one of the most common problems with the customer

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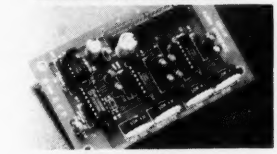

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sending in his unit is "Inadequate packaging. Please use the original box and packing. If they are not available, use a heavy double wall cardboard box that provides approximately 6" of packing material on all sides. DO NOT USE CRUSHED NEWSPAPER FOR PACKING MATERIAL!!! Use styrofoam beads and add cardboard buffers to prevent shifting of the contents with heavy units. Send only one unit in each box! Don't try to save $10 in shipping charges only to cause $150 in shipping damage. We recommend shipment via UPS since the USPS can take up to one year to settle a claim for a damaged or lost shipment. Also, no description of problem, no return address, and no phone number are problems."

Berger: "It is not necessary to call us before shipping if you follow the recommended shipping instructions. Before sending in any radio for service, take time to sit down and reread the operator's manual to make sure you don't just have a control or switch in the wrong position!"

Making Repairs

A Kenwood service technician says, "Service warranty is 30 days parts and labor. It's not hard and inflexible. We allow a reasonable grace period."

Average repair costs run $45 per hour plus parts. Handhelds and VHF mobiles average an hour; HF mobiles, 1-2 hours; HF base, 1-3 hours; old tube rigs, 2-4 hours; and large accessories, 1 hour. The charge for small accessories may be parts or labor.

Average turnaround time runs from 5 to 10 working days (this does not include weekends or holidays!).

All warranty repairs MUST be accompanied by a photocopy of the bill of sale. The warranty card is not required for service under the warranty, however Kenwood does encourage the timely submission of these cards.

All accessory items, such as microphones, filters, tone boards, etc., must be obtained from the dealer.

The customer has the choice of sending the unit to his dealer, to one of the outside service agencies, or directly to Kenwood. There are 66 dealers and five outside service agencies.

The Kenwood Bulletin Board

Kenwood has established a bulletin board system (see the Table) for customers. The system, capable of working at 2400 baud, is up from 17:00 to 08:00 the following work day. Current files include most service bulletins, general ham notes, sample computer control programs, some ARRL bulletins, input from *Westlink*, etc. Users are granted full access when they first sign on.

Kenwood encourages you to download as many programs/files as you might find useful. If you have a file that you think might be useful to others, please feel free to upload it.

Martin: "If you have a technical question, leave a note to the SYSOP or leave a general note for all. We are confident that you will have an answer shortly (usually the next work day, if I have the information!). New product announcements will be made here as soon as they are released by our sales department. We think this is the best way to get and pass along technical information about our products in the future, considering the number of computers in ham shacks these days.

"Future plans for the board will include 24-hour access and multiline inputs as the number of users increases."

Readers Respond

I was impressed with Kenwood's interest in letters from dissatisfied customers. They are eager to work with customers and take the steps necessary to streamline the service procedure.

Unfortunately, intermittents and recurring failures happen, generating "nasty grams." Sometimes recurring problems originate at the ham end of the picture—front-end overload, poor grounding techniques, and the like.

Here are some responses from *73 Magazine* readers:

Emmett Foster KA6MJC: Satisfied with Kenwood service after 4 attempts to get a TS-940 fixed. Kenwood finally replaces.

Jim Welch KK6N. Satisfied with local dealer repairing his Kenwood product.

Carl Schworer N2EOQ: Unhappy because not compensated for an unrepaired set returned "inoperative."

Bill Alber WA6CAX: Delighted with quick turnaround of Kenwood handheld (less than 2 weeks).

Paul Dobosz K8PD: "Quick turnaround—problem fixed—technical service personnel were helpful on the phone and set (TS-120) came back fixed within 2 weeks."

Peter Eaton KH6HBZ: HF mobile quickly repaired, but says, "My main gripe is that the factory always says they've never heard of that problem before."

Stan Podolski KA2BUG: His radio repair was delayed because he first went to a local Kenwood dealer that was not able to repair the set after 3 weeks of bench time; he feels most dealers should say when the repair is too much for them and get the set off immediately to the factory.

> ***". . . everyone is trained to work on many types of rigs."***

Richard Booth AB4LG: The actual defect was never identified, but the problem was cured promptly. "Personnel on telephone were extremely courteous. Company stands behind warranty."

William Hess W3RIK: His 940 was finally repaired after the third time. "For a $2,500 unit, to have to spend $46 out of pocket for something not my fault is ridiculous." Bill sent along a detailed letter of his service problems.

Twenty other questionnaires were returned—evenly mixed between liking and not liking Kenwood service. The biggest problem seemed to be their inability to communicate with the factory directly by phone. The new Bulletin Board System should help, and both Martin and Berger believe their new phone system may eliminate this problem for good.

Regional Kenwood Service Centers

Kenwood is promoting a professional "get it fixed, fast" plan that has served the commercial land mobile radio industry for years—regional service centers.

Kenwood Service Centers are authorized for free warranty repair of amateur radio transceivers, plus the quick repair of ham sets that are old and out of warranty, at about the same repair charges as if you had sent it directly to the factory.

Berger: "Our customers that may need an immediate overnight, quick fix of a transceiver may wish to contact their local area Kenwood Service Center." Joel points out that all "KSCs" have a good supply of Kenwood parts, a full complement of Kenwood service manuals and up-to-date service bulletins, and most important, qualified personnel that know Kenwood ham transceivers inside and out. "One of our KSCs, Land Air Communications, specializes in the restoration of early Kenwood transceivers, such as the popular Kenwood 'Twins' (transmitter/receiver sets). I mean, Land Air Company makes it their evening and weekend business getting old Kenwood sets back on the air, even if they have to create some no-longer available components!"

Going on a long cruise next week, and discover your TS-440 has an intermittent display? That local KSC in the next town or state knows about the problem and has a service bulletin that may let him fix it within a couple of hours by replacing a plug-in digital logic chip with a new chip that solders in.

But I can hear your resistance to a service center already—are KSCs really as good as factory personnel? Do they have the necessary parts on hand? Are the rates the same, or lower, for most repairs? Is there a ceiling on the maximum amount they might charge you to get a set fixed? Will they honor a warranty claim when the set was not turned on until after the warranty ran out?

Berger: "Most authorized Kenwood amateur radio dealers provide full service support. Kenwood always suggests you contact the dealer from whom you purchased your unit for fast, courteous service."

Independent Service Centers

In addition, Kenwood also supports a growing group of dedicated service professionals. Why go with an Independent?

All Independent Kenwood Service Centers are fully authorized by Kenwood, and most Service Centers have a radio technician who is Certified Factory Trained by Kenwood USA Corporation. These professionals handle service for your region. Why send your radio cross-country? Less transit time means less wear and tear on your radio, and lower shipping charges. Since they are service-only specialists, they are not the "back room" at a radio store.

Independent Kenwood Service Centers can expeditiously service units both in and out of warranty. All Kenwood servicers (independent, dealer, or factory) use genuine Kenwood parts. It's a hard and fast rule! Full details on the Kenwood USA Service Network are available on the Kenwood BBS (see Table 1). Go to Bulletin Menu, then Bulletin #1. Or contact Kenwood USA Corporation for a current "amateur radio service listing."

ICOM also offers regional repair centers as an alternative to factory service. Yaesu is planning to take advantage of outside service specialists.

And for the rest of the professional communications markets, regional service centers have well established themselves as being one of the best places to send your set.

Stay tuned! Next month we visit the ICOM America Service Department.

Kenwood Telephone Information

Parts:	(213) 639-9000, Ext. 422 or 429
Service:	(213) 639-7140
Status Checks:	(213) 639-9000, Ext. 266
Sales Information:	(213) 639-4200
Bulletin Board:	(213) 761-8284 (8 data, no parity, 1 stop bit)
Hours:	From 08:30 through 17:00 Monday to Friday, Pacific Standard or Pacific Daylight time, excluding holidays.

Independent Kenwood Service Center Specialties

United Radio, Syracuse NY. (315) 446-8700.: Kenwood amateur VHF and UHF radio products; no HF service at present.

Land Air Communications, Richmond Hill NY. (718) 847-3090. Any Kenwood amateur radio product in or out of warranty, including vintage models.

Ham Radio Repair, Kennesaw GA. (404) 422-1415: Fix any Kenwood amateur radio product in or out of warranty, but usually not handhelds. Please call first regarding handheld service.

Robert Hall Electronics, San Jose CA. (408) 729-8200; GE Electronic Services, Bensenville IL. (312) 592-4343; Resource Electronic Corp (201) 772-1279, Radio Systems Inc. (404) 449-4150, Groton Electronics (508) 448-3322: Any Kenwood amateur radio product in or out of warranty.

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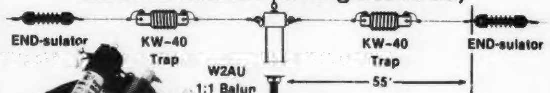

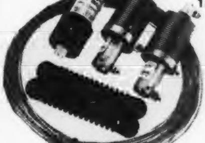

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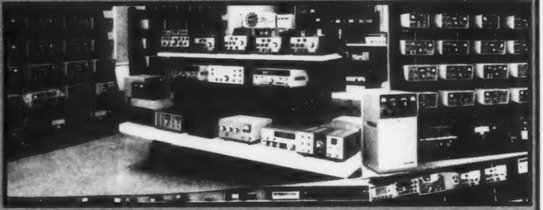

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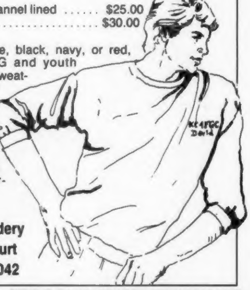

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Never Say Die

Continued from page 4

didn't want to miss out on the fun of selling. So I've got her rigged out with a home computer networked to WGE. She's having a great time selling from home . . . and has almost doubled her sales over last year.

Golly, it's tough working in New Hampshire where the air is clean, the summers are cool and the skiing great in the winter. The view from the WGE building is breathtaking. We're the only major business in Hancock. Heck, even the housing prices have been coming down recently.

The next town over, Keene, is a great resource, with seven movie theaters . . . frequent live music performances . . . and Keene State College.

I hope you didn't miss the recent Tom Peters "Thriving On Chaos" series. He and I agree that progressive firms run best with an absolute minimum of management. Our motto is, "If it ain't broke, fix it anyway."

Greener Pastures

How'd I ever get into the record business? It's just one of those things that was bound to happen. It could happen to you, if you're open to new opportunities.

When I saw *The Sting,* I heard Scott Joplin's ragtime music and said, hey, where's this been all my life? I bought every Joplin record I could find and played them day and night for months. The more I listened, the more I could sense the music Joplin had written, but the performers were missing. It was frustrating.

As the publisher of *CD Review* I met many record company presidents. I kept telling them to find someone able to actually feel Joplin's music and make it available. None of 'em did anything about it.

Joplin's music is extremely difficult to play. It takes an experienced concert pianist to handle it. Every time I'd meet a noted concert pianist I'd ask if they could play Joplin. I struck out.

Then, last year, I was in New Orleans for a music conference and happened to walk by a dingy little bar late one night. Ragtime piano music was pouring out the open door. I stopped in my tracks. I listened. Holy moly, who's doing that?

A couple hours later I'd signed Scott Kirby to record Joplin's music. Scott, a college graduate with concert piano training, was playing Joplin all day on the streets of New Orleans with his piano on wheels and at night in The Grapevine bar.

I brought him to New Hampshire, where we recorded his first CD release on a concert grand Steinway piano in the Peterborough Unitarian church. The piano was excellent and the church acoustics outstanding.

But Scott wasn't satisfied. The sound was good, but it wasn't perfect. So with the help of my ex-bookkeeper, Knud Keller KV4BB, now a piano repairman, we found an 1896 Bradbury and an 1898 Steinway. Both were upright concert grand pianos . . . the same as Joplin would have used when he played the music. The Bradbury was ideal for the ragtime dance pieces and the Steinway perfect for the Joplin concert pieces.

We converted the garage at my farm to a studio. Knud, who used to be a concert pianist, restrung the Steinway bass strings and then Scott set about getting used to the pianos. He played night and day for over three months, recording the results only when he had everything perfect.

The recording equipment and techniques were state-of-the-art, using the newest Panasonic 3500 DAT recorder and an AKG stereo mike. The sound is absolutely incredible, thanks to David Torrey, our sound engineer and data processing guru. He's also the brains and sweat behind our CD-ROM project.

The first CD release is out (GP-01), if you'd like to find out what all the fuss is about. It's available from Music/NH for $18 (plus $3 postage/handling). It's also available on cassette for $10 ($3 P/H). You can hear for yourself why I rate Joplin as the greatest composer America has ever produced.

There are 64 known Joplin works. We expect to have 'em all available by the end of this year . . . as boxed sets of CDs, DATs and cassettes.

So that's how I get into new ventures. Now we're planning on doing some bluegrass using our biaural recording technique. And if I can make the right connections, we'll probably be recording outstanding Eastern European artists so we can help them survive the change from communist systems to democracies.

Participation in new ventures such as Greener Pastures is open to anyone at WGE who's interested, so there's no limit to what one

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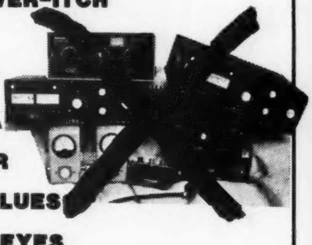

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can learn or do here. I prefer not to coddle drug addicts . . . and that includes alcoholics and smokers.

One disappointing aspect of being successful is that there are publications which generate attention by throwing dirt . . . and seem to have no respect for truth.

Almost Upset

When I read in *Insight* magazine that the Commerce Department was getting ready to do an end run around the FCC, I almost got upset. The department's National Telecommunications and Information Administration (NTIA) is planning to review the present system for allocating the nation's airwaves. The study will even look into the possibilities for raising revenues through the auction or leasing of frequencies.

Well, I've been warning you that something like this could come along . . . and you've been snickering and pooh-poohing it as doom and gloom. I've been griping that the feeble amount of public service we provide these days would never stand any honest inspection as justification for the hundreds of billions of dollars in frequencies we've been allocated . . . and 99% of which we haven't even bothered to use.

Between cellular phones, high definition TV, personal communications networks (PCN) and other already known developing communications systems, the need for radio spectrum is going to be a hundred or even a thousand times larger than it is right now. Fibre optics will help improve office and home communications, but if you're going to set up a system where people will be able to communicate from anywhere . . . walking, driving, shopping, even in the movies . . . we're talking radio spectrum.

One of the last things we need is for some government agency to do an honest evaluation of the radio frequencies and balance actual public service against the current spectrum allocations. All our posturing and exaggerations about the enormous value of amateur radio could be mercilessly exposed. We might even have to stop fooling ourselves and come to grips with what we've allowed to happen to what was a few years ago a very valuable national resource.

Right after seeing the *Insight* article, I read a ham newsletter report which pointed out that the FCC has gotten so fed up with the complaints about the mess on 20m created by KV4FZ, IARN and others, that they're considering ending all phone patches and even ham news broadcasting.

I got to mulling over what's gone wrong with amateur radio. How come we're no longer self-policing? We've bragged for years about how we're the only self-policing radio service, yet whenever we have any problems the ham reaction has been to immediately go crying to the FCC or a congressman for help.

The more I thought about it the more aggravated I got. Heck, I almost got mad. No, I didn't get mad at the FCC . . . that's a real waste of time. And I didn't get mad at the Commerce Department which is promising to do what the FCC should have done anyway. No, my irritation was with our beloved ARRL. I'll tell you why.

For some reason I was put in mind of a long ago incident in New York. Kitty Genovese was being brutally murdered and was screaming for help. She upset the whole neighborhood. They looked out their windows and saw her being murdered, so they pulled down their shades. They turned up their TV sound to cover her screams. They didn't want to get involved.

We've been having little murders in amateur radio (apologies to Jules Feifer) and not only have most hams been turning a deaf ear and a blind eye so as not to get involved . . . much worse, our only national amateur radio organization has also not been getting involved.

Little murders . . . like the Southern California 220 mess . . . ham suers . . . DX pileups and jamming such as the recent apparently lousy operating from Bouvet . . . bad language . . . emergency net jamming . . . repeater jamming . . . gratuitous nastiness on the air and in some ham publications I could mention . . . complaints to the FCC . . . irresponsible rule change proposals . . . making it unpleasant for kids to attend ham club meetings . . . crooked VECs.

I can almost understand why individual hams have wimpily allowed these murders. But how come the ARRL hasn't accepted the responsibility to provide leadership and guidance for amateur radio? Is the ARRL a wimp too? When it started to become clear that our self-policing was failing, where were they with a fix? Where have the ARRL Official Observers been when we have had net jamming . . . bad language . . . and so on? Has the League organization just sat there, limp wristed, afraid to get involved?

When it is becoming ever more clear that leadership is needed, where has the ARRL been? Have they been too wrapped up with their new commercially built ham station . . . with planning a $10 million museum . . . with proposing major rule changes to the FCC without consulting the membership (or even the directors)?

I can understand why 99% of the amateurs wouldn't want to get personally involved with trying to do anything to help amateur radio . . . being a wimp, unfortunately, is human nature. But how come our national society . . . our *only* national ham organization . . . has so seriously abrogated their obvious responsibility?

As I say, I darned near got mad. It was close . . . but I didn't want to chance giving the totally erroneous impression that I'm attacking the League and again find myself being burned in effigy at National ARRL Conventions. Heck, for many years the League refused to let me buy a booth at their conventions or to allow the convention committees to let me talk.

Perhaps, if we started looking for non-wimp directors to elect? How about looking for some directors who have actually accomplished something in life more than working their way slowly up through the League hierarchy? How about looking for directors who have some real accomplishments? Of course if you feel better electing hand-wringing wimps who haven't the guts to provide the leadership which is so desperately needed right now, that's your choice.

Fortunately I don't feel strongly about this . . . I just thought you might want to think about it. Probably not.

Should We Sue?

Yes, I know I'm out of step with society. I'm the guy who speaks up when I see something wrong. It's gotten me into all sorts of trouble all my life . . . but I can't stop. Perhaps it's a defective gene or something . . . maybe terrible early training.

I've found myself almost exasperated at the SoCal hams who for years have put up with the worst repeater mess in the entire country in pained silence. They whine that the bad guys are too strong, so the good guys are afraid to really say or do anything about it.

When I hear bad operating I put on my Lone Ranger hat and charge into the fray. I let 'em know what I think in no uncertain, but not profane terms. Meanwhile I hear almost everyone else wimping out.

You know, if you'd stand up for what you know is right, we'd get rid of the garbage on our bands in short order. We have a hobby which has an incredible potential for benefiting both our country and the whole world . . . if we would run it right.

Here we are, with the potential for developing a fantastic array of new communications modes . . . modes, many of which will have to depend heavily for their success on our currently unused microwave spectrum allocations . . . and we're arguing over code vs. no-code and other deck chair on the Titanic re-arranging.

If amateur radio is going to be of value to our country . . . if it's going to warrant the extravagant frequency spectrum allocations we've inherited from the early hams who really did pay their dues . . . who did fulfill the bargain in Part 93.1 . . . we've got to make some major changes and make 'em fast. And, lacking any discernible leadership from Connecticut, maybe it's almost time for us to stop waiting for help from mama and go out on our own.

In exchange for billions of dollars in frequencies we agreed to provide a source of technically trained people for our country which will be of value in time of war. Fine, we did just that in the 1940s when 80% of all licensed hams joined the armed forces. We hams helped substantially to win that war . . . a war in which electronics turned out to be a deciding factor. I know because I was one of them.

My ham receiver went to the government for use by the Rubber Development Corporation in Brazil. And I joined the Navy as the electronic technician on the *USS Drum* and helped sink quite a bunch of Japanese ships.

Today you won't find the military much interested in attracting hams. The average level of ham electronic education today is so pitiful it's irrelevant. Indeed, the level of ham technical education compared to the state of the art today is pathetic compared to what we provided the government in the 1940s.

For instance, when I publish

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*16 External relay controls
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*CW Practice with voice
*Security mode, T.tone mute
*Voice announces each user call sign when logging on

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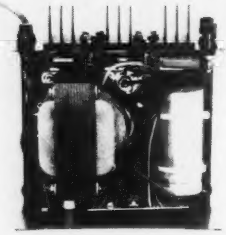
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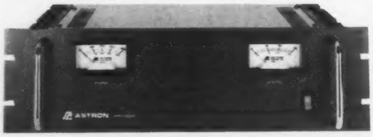
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RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

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MODEL RS-7A

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RS-4A	3	4	3¾ × 6½ × 9	5
RS-5A	4	5	3½ × 6⅛ × 7¼	7
RS-7A	5	7	3¾ × 6½ × 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 × 7½ × 10¾	11
RS-12A	9	12	4½ × 8 × 9	13
RS-12B	9	12	4 × 7½ × 10¾	13
RS-20A	16	20	5 × 9 × 10½	18
RS-35A	25	35	5 × 11 × 11	27
RS-50A	37	50	6 × 13¾ × 11	46

RS-M SERIES

MODEL RS-35M

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RS-50M	37	50	6 × 13¾ × 11	46

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VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	5	7	4 × 7½ × 10¾	10
RS-10S	7.5	10	4 × 7½ × 10¾	12
RS-12S	9	12	4½ × 8 × 9	13
RS-20S	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

simple, basic technical articles in *73* I get screams of anguish from the older readers...too complicated! Way over our heads!

Amateur radio, if it is to live up to its mandate as expressed in our rules, needs to make some major changes. Every one of us needs to take an interest in continuing our electronic education and building our communications skills. Calling in on some net every week doesn't cut it. Rag-chewing several hours a week isn't it. Making DX pileups worse isn't it, either.

How much have you learned about packet radio? Did you grumble in frustration when we devoted a whole issue to packet? Or did you say, hey, lots of ops are having a ball with this, it's time for me to find out what it's all about?

Sure, you're going to have to learn something about computers and build some new operating skills to use packet. Ditto if you're going to do some operating on Oscar, RTTY, SSTV and so on. Every time you conquer a new mode you're going to find yourself that much more excited about amateur radio...and proud of yourself for the new skills you've built.

If you get off dead center and try new modes...if you lend a hand in cleaning up the garbage infecting our bands...if you start bringing youngsters into our hobby and making it fun for them...if you stop waiting for Godot to turn up and tell you what to do...you'll help make amateur radio not only a more exciting hobby for the rest of us...you'll have the time of your life. And, best of all, you'll look forward enthusiastically to an honest evaluation of the value of amateur radio when a Commerce Department or FCC survey is in prospect.

Japan, with over twice as many licensed hams and half our population, has been running circles around us. I haven't found any industry people who don't believe that this has had a lot to do with America losing all of its consumer electronic industries to Japan. Fellas, we did that.

The sooner we recognize that we have no leader, that the responsibility for our existence lies with each of us, not with a small group in Connecticut whose main interest is publishing, the sooner amateur radio will blossom.

Alas, we tend to mystify The League. If you take the trouble (and expense) to send for the yearly League financial report, you'll understand it much better. All you have to do is follow the money. You've heard that before, right? Well, most of the ARRL's money comes from publishing...from *QST* subscriptions and advertising, so that tends to wonderfully concentrate their attention.

Sure, we'd do better with some strong leadership, but we know what we should do, so we can do just fine without it. We know that every one of us should be building our communications understanding and experience...that we should be vigorously going after youngsters and building our ranks...that we should be pioneering new technologies.

With the winding down of the Russian military threat, it's all the more important that amateur radio do everything possible to help our country get back to number one in electronics in the world. You see, without that threat the mighty American military machine will tend to fade away and that might deflate our arrogance as we begin to recognize that America is no longer the most important country in the world.

Without our military might, and with Japan...and perhaps Germany...beating us industrially and financially, we could find ourselves in the position Britain did when it lost its empire and stopped being "Great" Britain.

ARRL President Urged To Resign

Entirely coincidentally, after writing the above indication of my annoyance, I've learned that five well-known hams have asked Larry Price W4RA, the ARRL president, to resign. They cited that he had failed to "adequately meet either the domestic or the international challenges that face amateur radio today, and that a change in ARRL leadership is absolutely necessary if we are to survive these challenges in the coming decade."

So here we have heard the same basic complaint from Stu Cowan W2LX, the publisher of a wide range of ham books; Pete Hoover W6ZH, son of Herb Hoover Jr., a past president of the ARRL and grandson of president Herbert Hoover; Joe Schroeder W9JUV, the past publisher of *Ham Reports*; Prose Walker W4BW, a past head of the FCC's amateur radio division; and Bill Orr W6SAI, one of those who greatly helped ram through incentive licensing 25 years ago.

They blame Price for the League's financial crisis, for fail-

Continued from page 82

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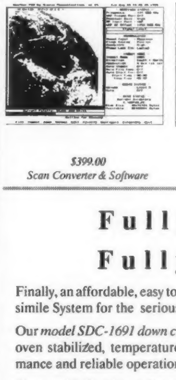
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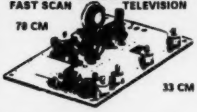

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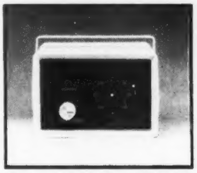

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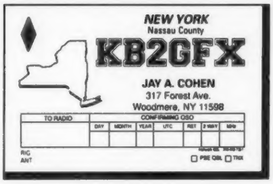

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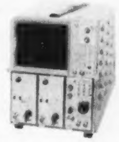

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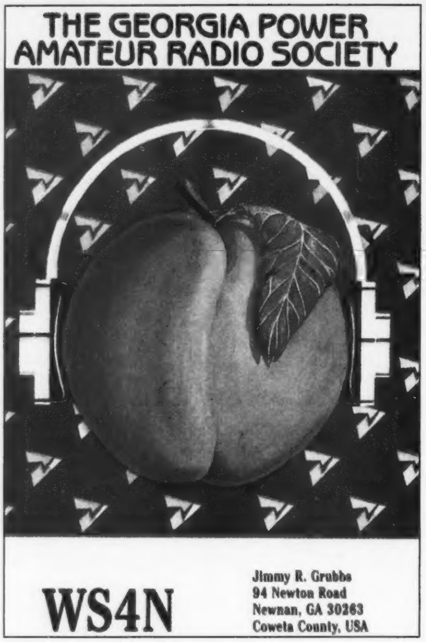

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AMATEUR RADIO SOCIETY

WS4N

Jimmy R. Grubbs
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ure to take a leadership position on a long list of domestic situations, for failure to adequately prepare for the coming 1992 WARC, and for being abrasive and hard to deal with, causing poor relations with both the IARU and FCC.

I suppose that my complaint about the lack of leadership does come down to the president. My solution, knowing the virtual impossibility of changing presidents, was to suggest that perhaps it was time for us amateurs to just go ahead and solve problems ourselves.

Of course it's beyond our purview to deal with the IARU alienation and its ramifications. It's a little late for us to start doing the massive international homework needed to protect our amateur frequencies at WARC in just two years. When one remembers, as I do since I was there as an official delegate representing amateur radio, how close we came to losing amateur radio almost completely at a past WARC, I'm wondering why the angry five didn't file criminal charges against the ARRL directors for their paralysis in allowing the situation to get so bad.

The five hams who've attacked Price have one thing in common. All are keenly aware of what's going on at all levels. They have the industry, FCC and international background to know what has been happening . . . and what should have been done.

Repeater coordination battles have been permitted to escalate to the FCC level. Ditto third party traffic problems, hurricane and earthquake disaster communications problems and electromagnetic radiation questions. And suing the FCC hasn't helped improve relations either.

The unanimity of five key hams urging Price to resign should be enough to convince all but the most dense ARRL supporters that there really are problems and that this isn't a case of Wayne or others "attacking the League for some frivolous reason." If you're not worried, then you don't understand what's going on . . . and you are part of the problem, not part of the solution.

Many other industry leaders would speak out if they weren't afraid of League retribution. They are quite vocal at ham industry meetings, but fear of the League's power, which is considerable, keeps them quiet. Remember too, that all our largest ham industry firms are Japanese, and that they tend to avoid interfering in what they see as our American domestic problems.

Well, you may not want to personally do anything, but at least I've given you something to talk about on the air other than the model number of your rig.

Number 30 on your Feedback card

73 INTERNATIONAL

edited by C.C.C.

Arnie Johnson N1BAC
103 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

New Hambassadors

Good news for all of us. Two new Hambassadors have joined the ranks of 73 International.

Phil Gray KA7TWQ, while working with CARE in Mozambique, has volunteered to keep us up to date with the happenings there until a Mozambican ham is discovered or comes forward. I'm certainly looking forward to his reports. A short one is in this column.

Jonas Paskauskas, head of the Siauliai club station LY2ZZ, has been persuaded (didn't take much) by Paul Pauliukonis KB1TY to pass on the latest information from the Baltic Republic of Lithuania. We are probably all aware of the recent political status of Lithuania and the USSR, and changes are being made on the ham front as well.

TRAVELING TO THE EMERALD ISLE

Many of you are probably a lot like me; I enjoy traveling, seeing new sights, and hamming on the way. I was fortunate to be able to travel to Ireland, Scotland, and England last summer with my family, but without ham gear.

By the time the plans were finalized, it was too late to send off for approval to operate in the British Isles. I really felt lost without an HT in my hand.

We traveled mostly by bus with 30 other people, except for the short flight from Dublin, Ireland, to Glasgow, Scotland, and the train from Edinburgh, Scotland, to Birmingham, England. Now that I think back on this trip, it is the first time in many, many years that I was not doing the driving, and I took full advantage of it.

I had lots of time to view the wonderful scenery, the stone fences, castles, and houses with thatched roofs, many built long before the USA was even a colony of the British Empire. I even kissed the Blarney Stone and gained the "gift of eloquence." I've had some people say that I'm full of Blarney, and maybe they are right.

I also found myself looking at the roofs and backyards of the houses for signs of ham antennas. I don't remember seeing many, but I know there are many hams living there. I vowed that if I ever returned or traveled to other countries, I would apply for a license to operate and take a radio with me.

I got my wish! My wife and I are planning to take her mother to see her family in Ireland. The trip will probably occur between May 30 and June 14. There will be a few free days and evenings during the tour.

I plan on operating 2 meter HT bus-mobile. Maybe someone can advise me on whether I need to practice whistling up repeaters, get a tone generator for my trusty IC-2AT, or need do nothing special to bring up the repeaters in Ireland.

The itinerary includes evening lodging in: Ennis, Killarney (2), Waterford (2), Dublin (3), Rossnowlagh (2), Galway (2), and Dromoland Castle, with traveling between and around.

I am really looking forward to the return trip to this beautiful country. If any of the hams of the Emerald Isle would like to get together with me during my trip, please contact me at 73 Magazine *(mail or BBS), at my address at the top of the column, or via PACKET,* N1BAC @ W1FYR.NH.USA.
—Arnie, N1BAC

ROUNDUP

Japan From the JARL News:

New "WARC '79 AWARD"

From the 10, 18, and 24 MHz allocated to amateur service at WARC (World Administrative Radio Conference) '79, the latter two, i.e., 18 MHz and 24 MHz became exclusive for amateur radio use on July 1, 1989.

Commemorating this, JARL decided to start a "WARC '79 Award" to encourage the active use of the bands. Applications will be accepted as from February 1, 1990.

The essential requirements of application for this award are as follows: to make contact with at least 79 stations (one station from each of the 10 areas in Japan must be included) at more than one or two bands among 10, 18, and 24 MHz on the amateur bands, and obtain a QSL card from each (at each contact from July 1, 1989 through December 31, 1990). As it is an award of commemoration, an issue number will not be given.

All Asian DX Contest

The All Asian DX Contest '90, an international contest under the auspices of JARL, will be held as per the following schedule: Phone from 00:00 June 16 to 00:00 (UTC) June 18; CW from 00:00 August 25 to 00:00 (UTC) August 27.

South Africa From SARL Headquarters: In a dramatic meeting held on Friday, December 8, 1989, the Radio Sport Verband (RSV) abolished the ban against a range of countries. The radio amateurs in the German Democratic Republic (GDR) are now permitted to communicate with **ALL** other licenced amateurs in the world.

The German Democratic Republic was one of the first countries in the world to introduce a politically motivated ban against South Africa's radio amateurs. In South Africa any person may pass the radio amateur examination. Visitor permits are available on application to foreign amateurs of all countries. South African amateurs are permitted to communicate in all languages and are not restricted to communicate with amateurs of any country.

The South African Radio League recently appealed directly to the government of the German Democratic Republic and the Radio Sport Verband to abandon the prohibition. The radio amateur service in South Africa is hopeful that other countries follow the example of the German Democratic Republic and free the amateur service in their respective countries from any political interference.

Sweden From *Radio Sweden:* Publications—Bengt Friedewald has finally published

Calendar for April

1—Youth Day, Benin; April Fools Day, USA
2—Hans Christian Anderson, 1805; Emil Zola. 1840; Malvinas Day, Argentina; International Children's Book Day
3—National Day, Guinea; Ram Navami, Hindu
4—Anniversary of the Liberation, Hungary; Independence Day, Senegal
5—Arbor Day, South Korea
6—Victory Day, Ethiopia
7—Woman's Day, Mozambique; World Health Day; Founders Day, South Africa
8—Buddha's Birthday, Japan; Palm Sunday
9—Charles Baudelaire, 1821; Paul Robeson, 1898; National Day, Sierra Leone; Hanuman Jayanti, Hindu
10—First Day of Passover, Jewish
11—National Heroes Day, Costa Rica
12—National Redemption Day, Liberia; Holy Thursday; Jeudi Saint
13—Good Friday; Vendredi Saint; Thomas Jefferson, 1743
14—Pan American Day; New Year's Day, Bangladesh, Nepal, Burma
15—Easter Sunday; Anniversary of Military Regime, Niger
16—Easter Monday; Queen's Birthday, Denmark; Wilbur Wright, 1867; Charlie Chaplin, 1889
17—Evacuation Day, Syria
18—Independence Day, Zimbabwe
19—Republic Day, Sierra Leone; Constitution Day, Venezuela
21—Tiradentes, Brazil; Queen Elizabeth II; Feast of Riduan, Bahai
22—Vladimir Ilyich Lenin, 1870; National Secretaries' Week, USA; International Earth Day
23—Serge Prokofiev, 1891; William Shakespeare, 1564; St. George's Day, England
24—Victory Day, Togo
25—Liberation Day, Italy, Portugal; Anzac Day, Australia, New Zealand; Meenaksi Kalyanan, Hindu
26—Union Day, Tanzania
27—Arbor Day, USA; Samuel F.B. Morse, 1791; National Day, Afghanistan, Togo; Last Day of the Month of Fasting, Ramadan; Teej, Hindu
28—Id al-Fitir; Kenneth Kaunda, 1924
29—Emperor's Birthday, Japan; Shanka Jayanti, Hindu
30—Independence Day, Israel; Queen's Day, Netherlands; King's Birthday, Sweden

the new edition of his "International Listening Guide." The issue covers the period until March 24, 1990. It lists external and home service broadcasts in English to all parts of the world by time, and is an excellent reference. It also includes a detailed database by frequency showing which stations are on the air at various times.

This is the same as the heart of *Passport to Worldband Radio*. The latter's tables are easier to read, but the *ILG* is much cheaper, and is to be updated regularly. Assuming the *ILG* resumes regular publication, Radio Sweden recommends it and the *World Radio TV Handbook* as the best SWBC reference works. For more information, write: Peacewood Publications, Box 1112, D-3588 Homberg, West Germany.

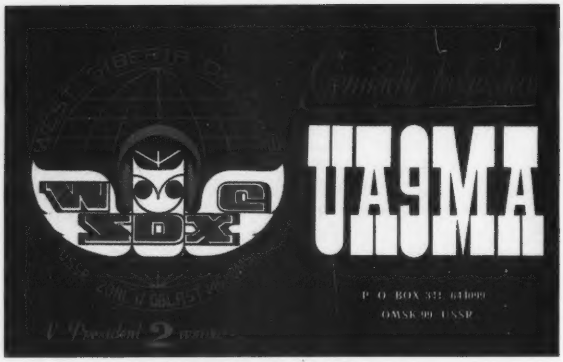
Switzerland International Telecommunication Union release:

Take-off of Mass Telematics

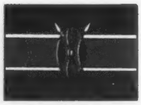
The 1990s will be marked by the take-off of a fifth 20th century mass medium following the newspaper, cinema, radio and television, namely mass telematics, also known as videotex. After ten years of infancy and battles over international standards, mass telematics will connect millions of users through the telephone and terminals smaller that PCs or microcomputers.

As the first medium based on both telecommunications ("tele") and informatics ("matics"), telematics has already started to upset the norms of mass communications and the management of everyday tasks. Its three features make it a more utilitarian medium than its four predecessors, one less leisure-based and far easier to integrate both into the conventional media (press, radio and television) and into domestic, professional or associative activities. Its interactivity enables the user to chose for himself the programmes he wishes to consult, and obtain information directly (games, comments and data of all kinds) compatible with the programme. Telematics is accessible to a far wider public than microcomputing, owing to the simple-to-handle terminal.

The economic implications of the new medium include not only the US$ 7 billion-worth of service sales and subscriptions across North America, Europe and Asia, but also the impact it will have both on household technology and on modes of communication in supermarkets, etc. Between 10% and 30% of mail order shopping is now effected by telematics with the major French companies, while the supermarkets are increasingly experimenting with the use of telematics as a guide to product selection in the consumer's home.



Gennady Kolmakov's QSL card.



KENYA

Rod Hallen 5Z4BH
AMEMBASSY Box 55A
APO New York 09675

Active during the recent Boy Scout Jamboree on the Air on October 21 and 22 was 5H0TSA in Dar es Salaam, Tanzania. Tom 5H3TW provided the station equipment and Tom and Rod 5Z4BH monitored station operation. The station consisted of an ICOM IC-730, MFJ antenna tuner and a long-wire strung between two palm trees about 30 feet above the ground. More than 300 contacts were made with 50 countries.

The total number of scouts attending the Tanzanian Jamboree is uncertain, but must have been somewhere between 700 and 1000. Almost all contacts were made by the scouts with just about everyone getting a chance at the mike.

The operation was so successful and generated so much enthusiasm that plans are being made to acquire equipment and obtain a license for a permanent station at the Tanzanian Scouts Association Headquarters.

The Radio Society of Kenya (RSK) has sponsored Jamboree on the Air stations in past years (5Z4LBP) but missed out this year due to lack of advance planning. Upon hearing of the Tanzanian operation, the RSK vowed to be back in action next year to give the boys in Dar es Salaam some competition.

[Another perfect way to develop the thrill and fun of amateur radio at a young age.]

LITHUANIA

Jonas Paskauskas LY2ZZ
PO Box 71
Siauliai, 235400
Lithuania

The LYA-LYZ callsign series has been restored to Lithuanian amateur radio stations. This callsign series was granted to Lithuania by the ITU in the 1930s, but was suspended during the occupation in 1940 and replaced by the Soviet Union's UP and RP prefixes.

LIETUVOS
RADIJO
MĖGĖJŲ
DRAUGIJA

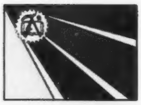
Banner of the Lietuvos Radijo Megeju Draugija (Lithuanian Amateur Radio Society).

As a result of this government action, the amateur radio stations are completing the changeover from UP and RP to LY prefixes according to the following conversion formulae: UP1 to LY1, UP2 to LY2, UP3 to LY3, UP0 to LY1, RP1 to LY2, RP2 to LY3, and U2 to LY2.

The only exceptions to the above are the five special events club stations (LY2WR, LY2WW, LY2ZA, LY2ZO, and LY2ZZ) which were temporarily issued LY callsigns last year and three amateurs (LY1VV, LY1BX, and LY1BQ) who had callsigns issued them before 1940.

This directive came out too late for incorporation into the 1990 Callbook, but should be incorporated in the 1990 Callbook Supplement.

[Looks like the actions of Sakalas Uzdavinys UP2BO (now LY2BO) and the delegation from the "Worldwide Lithuanian Amateur Radio Net" were able to receive approval for the callsign prefix change, as reported in this column in the December 1989 issue.]



MOZAMBIQUE

Phil Gray KA7TWQ
c/o CARE
C.P. 4657
Maputo, Mozambique

While the government of Mozambique has only issued one ham license over the past few years—C9MKT—and refused to renew it, we have hopes they will start issuing licenses again soon. In the meantime, I am very happy to volunteer my reporting skills until I leave, or a Mozambican ham is discovered or comes forward. There are none now.

[Very happy to have you step forward, Phil, and we are looking forward to more from Mozambique in the near future. Are there any more hams out there in other countries not presently serviced by a Hambassador? I was always told never to volunteer, but in this case I feel it is very important to let the rest of the world know what is happening. Still lots of openings. Volunteer now and avoid the rush.—N1BAC.] ■

QRP

Low Power Operation

Michael Bryce WB8VGE
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Massillon OH 44646

Time to Restock the Junk Box

Spring is the time for renewal. Also a time for hamfests. A time to restock the junk box for another long winter of building. This month we'll take a close look at what we need to pick up for the junk box.

Ah yes, the ham's junkbox; the builder's lifeblood. As the old saying goes, one man's junk is another man's gold. So it is with the junkbox.

What do we need to keep on hand for our low-powered construction projects? A second question: Should we go with new, used, or surplus parts?

Surplus parts can really be a godsend. What at one time the government spent thousands for, we can pick up for pennies on the dollar. The only trouble can be finding the same surplus part again. This can be a real pain if one of your buddies wants to make a copy of your circuit. This also can hurt a magazine project. If I can't get the part, I may not want to try to build it.

On the other hand, surplus parts are just great when you're looking for solid state devices. Transistors are usually military specified. That means the part meets or exceeds the specifications needed by the military. I've seen transistors, listed at over $25 each, for only $3. Now that's a bargain!

Goodies

Here is a good list of transistors to keep on hand: plenty of 2N3866s, some 2N3053s, and a handful of 2N4036s, great for switching oscillators and key devices. Of course, your junk box should have some 2N4134s, 4126s, 4401s, 3905s, and 2N3906s. And without question, a box of 2N2222s. If you can, get these in both the metal case and the popular plastic case, the TO-92. I've found that you can get better results with the metal-case 2N2222s, though I really don't know why.

Keep some LM324 op amps on hand, with a dash or two of some old favorites, like 741s, LM339s, and of course, LM386 audio amplifiers. These are used in so many QRP construction projects that no one should be without them. Additionally, no junk box is worth its salt if it doesn't have a dozen 555 timer chips on hand.

Chips and Parts

Since digital electronics is creeping into more QRP circuits, I keep on hand a supply of the most common CMOS 4000 series chips. A dash of the older 7400 TTL chips would not be a bad idea, either.

I keep my IC chips on anti-static mats. Radio Shack sells these for a couple of bucks. The mats fit inside a cigar box with ease. I place the ICs on the foam with the numbers in order. This makes looking up a chip very easy.

Of course, you need a good supply of both capacitors and resistors. As the size of QRP projects get smaller, the junkbox's parts should reflect the trend. Small disc capacitors and electrolytic capacitors are a must. Keep a good supply of silver mica caps. They're great for output filters in transmitters. Keep a supply of the most common values. Don't forget some NPO types for VFO and other frequency-dependent circuits.

By digging for dead radios at flea markets, I can fill the junk box up quickly. You can get a lot of good parts from dead CB radios. You can always use the PA and driver transistor in QRP transmitters.

Who knows? You might even pick up an HW-7 in good condition for next to nothing.

Hot Water Handbook Update

Now for the bad news, in case you do find your dream HW-7. The *Hot Water Handbook* is all sold out. There are no copies left, so don't write and ask for a copy of the second edition.

I still don't have enough new material for the third edition of the handbook. Again, if you have a modification for the HW-7, HW-8, or the HW-9, please send it to me. If I use it, you'll get a free copy of the third edition of the book when it comes out. I don't know when this will be, but look for something late in the year.

Modification for Ten-Tec Knob

While digging through the mailbag this month, I found a letter from Don Garrett WA9TGT which may interest Ten-Tec owners.

His first mod I can relate to. If you have ever owned a Ten-Tec HF rig, you may have had to replace a front panel knob. Seems you really have to screw down the set screws to keep the knob from slipping on the shaft. The problem appears to be the plastic wall that forms the outer ring of the ¼ shaft cavity. This wall sometimes breaks out or cracks, making the knob unable to tighten the set screws down on the shaft. The knob then slips on the shaft, no matter how tight the set screws are.

This failure most commonly occurs on the band switch knob, since it must be well-tightened to prevent slipping while you're turning the band switch. My Triton 4 had this problem. Don's solution is to reinforce the knob shaft cavity wall by filling the space between the plastic wall and the outer knob shell. He uses epoxy glue. Allow the glue to dry for 36 hours, then you can tighten the knob's set screw without breaking the knob. Don tells me this fix completely eliminated the knob failure problem.

Argosy I and II Modification

As the owners of these radios know far too well, the lack of an RF gain control is a pain. Because you can't control the RF gain, you hear an annoying chopping sound in the receiver's background noise. This happens when you're sending CW during higher-than-normal QRN and AF gain levels. Normally, a reduction in the receiver RF gain setting would compensate for this.

Attempting to add either an RF attenuator or a separate RF gain control is difficult because it's hard to find a dual concentric shaft 10k pot. This modification does not deal with the RF part of the Argosy, but rather with the AGC.

Don's approach to correct the chopping receiver background noise is quite simple. Locate C40 for the Argosy II or C45 for the Argosy I. This capacitor is located on the audio/IF board. Its value originally is 1 mF. Change this capacitor to a 10 mF at 16 volts. It will be necessary to remove the audio/IF board to change this capacitor, about a ten minute job. It is not difficult at all. Installing the 10 mF capacitor in place of the original 1 mF capacitor will result in a slight delay in the recovery time of the receiver, and will eliminate the chopping of the receiver background noise. Don tells me this is the same method used in the Corsair II slow QSK position. Be especially careful to match the proper polarity when installing the new capacitor.

While I've never done this modification, it should work quite well. I've normally turned down the audio on my Argosy II when the QRN or QRM is high. I don't see why you couldn't add a switch, and perhaps a relay, to switch between slow or fast receiver QSK.

I'll have more building projects in the coming months. Be sure to send in the reader service cards—that's one way to generate a steady supply of information for you, the QRP operator.

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ATV Dayton Hamvention Activities

This year's Dayton Hamvention promises plenty of ATV-related activities. When you arrive in the Dayton area, you can monitor the local action on 147.45 or 144.34 MHz. Portable ATV stations from all over the country attend, with some very interesting mobile-to-mobile and even motel room-to-room portable contacts (Earl KS8J generally requests the highest room at his motel). Bring your portable ATV receiver and watch the fun at the hamvention. A trip through the parking lot can net you some enjoyable contacts from RVs and vans. Look for K3ZKO's well-equipped mobile, and for KB2CXM in the Buffalo group's RV.

The local W8BI ATV repeater has good coverage in the hamvention area with input on 439.25 and output on 426.25 MHz. The repeater is vertically polarized, but most of the local simplex activity is horizontal. From the exhibitors' area, you should be able to see several ATV signals from the AEA, PC Electronics, and Wyman Research booths. In the flea market, be on the lookout for the telltale sign of any ham carrying a TV camera with whip antenna attached. You no longer have to describe that great piece of "bargain junk" to your friends on your HT. . . just show it to them on their TV. It won't be long till the "Handie-Lookie" is a reality.

The Friday night ATV Party will be at the Best Western Motel (formerly Travelodge) on 3636 N. Dixie Hwy., hosted by the Western Washington ATV Society and *Amateur TV Quarterly* (ATVQ). Chuck W7SRZ will present the winners of the video tape contest. Several talks and video tape presentations are scheduled, as well as a home-brew contest.

During the hamvention, Tom W6ORG will present the ATV Forum on Saturday afternoon at one of the conference rooms in the O'Hare arena. Several speakers are scheduled to cover getting started on ATV and the latest balloon flight results. Jon WM8W will have his 16-foot ATV kite on display. This kite, shown in the February ATV column, was inadvertently printed upside down. Jon's call is WM8W, *not* M8WM, although many locals have been mistakenly using this inverted call on 2 meters lately.

Saturday evening at the Ramada Inn North there will be an ATV meeting with several speakers, and Spec-Com will sponsor some presentations.

Mobile/Portable ATV

A mobile station can really add a new dimension to ATV operations. Ernie WB6BAP got me interested in this mode during the mid 70s. It was quite a thrill to ride along with Ernie on the Pasadena freeway while sitting comfortably at home in front of my TV set. You can assemble a reasonable mobile station quickly, without using high-gain antennas and expensive hardline coax.

My mobile station consists of a 1 watt transmitter, a 100 watt amplifier, slightly modified B/W TV, video ID, TV camera on the dashboard, and a ¼-wave mag-mount on the roof (I use a 2-element quad in horizontally polarized areas). In the flatlands this setup will usually give me a 20–30 mile range.

It's great fun to roll into a distant ATVer's driveway for that undeniably snow-free picture. This is usually good for an excited "Wow, the band's really up!" from the unsuspecting victim—until he recognizes the front of his house. If you're lucky enough to have mountains nearby, you can cash in on some real DX. A mobile station at 5000 feet should outperform a monster antenna array at sea level. While visiting Santa Barbara, I was able to set up a small beam on a tripod at a scenic overlook at 3000 feet. This netted me a nearly snow-free picture on 1277.25 MHz from the WA6VLF San Diego repeater nearly 200 miles away.

Mobile operations provide a great way to meet the locals during long trips. On a trip from California to Ohio, I made over 80 two-way ATV contacts in eight states.

Photo A. Frank Williams WB9KCC and his detachable car-top beam and U-100 ROTOR. Note the use of bungie cords for quick installation.

WB8ELK/m
SPEED LIMIT 147.45
MOBILE

Photo B. When operating mobile TV. . . keep your eyes on the road!

Emergency Services

The ability to put together a quick mobile ATV station can be invaluable in case of disaster or emergency. Several groups are now using ATV to send a visual report to emergency services headquarters from roving mobile stations as well as from helicopters and airplanes. Those chasing severe weather systems could send a live view of the threatening storm to headquarters. Also, the chase vehicles could view weather radar to determine where to investigate. Many ATV repeaters have a live radar feed from the local weather bureau which can be accessed during severe weather.

ATVers can readily cover parades and special events with several well-placed ATV portables. Last May the Indianapolis group provided coverage for the INDY 500 parade from the tops of several skyscrapers. Last year the ATN (Amateur Television Network) of Southern California put on quite a demonstation for the annual Rose Parade. They set up over a dozen portable cameras at strategic intersections which relayed to a portable repeater on a tall building to send the signals to mission control. They even had two motorcycle mobiles as well as a helicopter covering the event. Any medical emergency or breakdown could be viewed quickly by the parade's coordinaters.

Mobile Antennas

As you travel around the country, you'll find predominately vertical or horizontal polarized areas. It's a good idea to have both polarities stacked away just in case. A good ¼-wave vertical should give you reasonable results. However, finding an omnidirectional horizontal antenna poses some problems. Two antennas which work best in this situation are the "Big Wheel" and the "Eggbeater."

The Big Wheel looks like a three-leaf clover with each leaf a ¼-wavelength element. It has a very good omnidirectional pattern and can be easily stacked for more gain. Olde Antenna Lab makes these, and Allied Appliance & Radio sells them (4253 S. Broadway, Englewood CO 80110). They call it the Mini-Wheel, and it's available in kit form or assembled. The Eggbeater, available from AEA, consists of two loops at right angles attached to a powerful magnetic mount.

I've used a 2-element quad with great success during my mobile trips. It gives me a 6 dB advantage over the whip antenna, but I need a large parking lot in order to rotate it! Several enterprising ATVers have used large beam antennas. Ron K3ZKO mounted a beam 6 feet above his van. This works well, but a close encounter with a low hanging tree limb can be a definite problem. Henry KB9FO has solved the polarization problem with a 20-element circular beam mounted on his side-view mirror bracket. This is one tough mirror mount, but it has survived 96,000 miles, and it has been wind-tested to 100 mph.

Frank WB9KCC has found the best compromise. He's actually devised a way of quickly mounting a small beam and a U-100 ROTOR on his car roof. Using a water pipe coupling attached to the end of the beam, he can easily flip the polarity. He even has a Radio Shack Fluxgate compass attached to the beam to give him true beam headings regardless of the car's position. If you try this, just remember to use a beam no longer than half the width of your car, or your antenna may end up attached to a passing 18-wheeler.

> ***"You no longer have to describe that great piece of 'bargain junk' to your friends on your HT . . . just show it to them on their TV."***

Portable TV Sets

Many inexpensive portable TV sets will actually receive 70cm ATV signals with little or no modification. These are usually the slide-rule tuning type. ATV operation is generally below UHF channel 14. If they don't quite tune down to the ATV band, usually you can modify them by adjusting an internal limit potentiometer. Check the UHF tuner's tuning voltage. If it stays above 0 volts when tuned below channel 14, a resistor or pot is probably limiting the low-end range. Shorting out this resistor or tweaking the appropriate pot may bring it into range.

When searching for bargain TVs I like to drive up close to the store and turn on my mobile TV transmitter. Then I look for the TV sets that receive the signal. This is usually good for a bewildered look from the salesman when he sees his storefront on the TV. Radio Shack sells two-color CCD pocket TV sets which not only tune the complete 70cm ham TV band without modification, but which are also very sensitive (Pocketvision model 22 or 23).

It's usually a good idea to run coax out from the UHF tuner to a BNC connector to bypass the 300-ohm balun network on TVs with twin-lead UHF connections. On most TVs a good preamp will help. An excellent and inexpensive GaAsFET preamp kit is available from Hamtronics (model LNW-432). A good preamp is also recommended for those of you attempting to view ATV on cable-ready TVs or VCRs (cable channel 58, 59 or 60).

Rules of the Road

One thing to remember when operating mobile TV . . . "Keep your eyes on the ROAD!" Have a friend drive while you operate the TV station from the passenger seat. Some states have laws requiring that a portable TV screen not be visible to the driver.

If you're traveling alone, transmitting from the car is perfectly all right, but try to pull over for the receiving end.

In order to make successful mobile contacts, it's important to find out where each local group hangs out. For your mobile viewing pleasure, drop me an SASE with your travel plans and I'll provide a sort of road service for Amateur TV . . . AAA–ATV? Keep 'em rolling and stay tuned. ■

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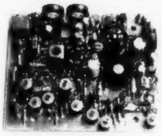

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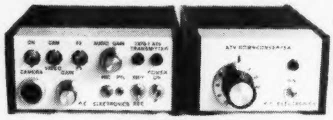

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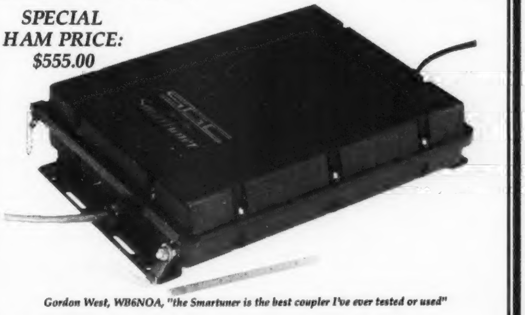

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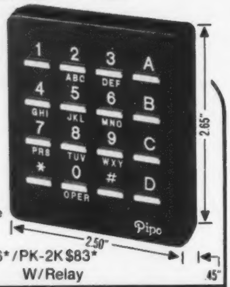

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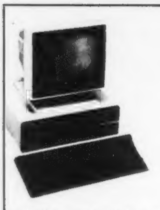

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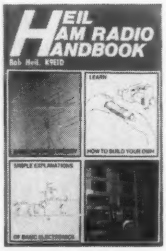

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Sunspots are back, we have the WARC bands, and multiband vertical antennas are monsters of complexity. All true statements? I thought so until until I stole several different designs (called research) and put them together to get a simple, cheap, and best of all, great working multiband vertical antenna.

Why a vertical? Vertical antennas have a very small footprint, a very important consideration for the city dweller. Vertical antennas also squirt a lot of signal at low radiation angles, and that means good DX! Most multiband vertical antennas use traps and have the advantage of working on several bands with a single coax feed. Unfortunately, all traps have some loss, no matter how well designed. And manufactured multiband trap vertical antennas tend to be expensive as well as complicated.

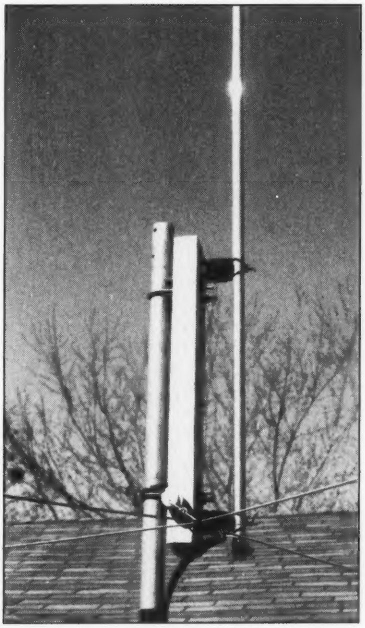
Open Wire, Tuners, and Radials

A vertical should be at least a quarter-wave at the lowest frequency. Without going heavily into theory, the gain of vertical antennas generally increases with length. A half-wave antenna has higher gain than a quarter-wave antenna. Vertical antennas, no matter how complicated, are basically just lengths of aluminum tubing stuck together. Therefore, if we can manage to get RF into it, a quarter-wave of tubing at 10 MHz should provide operation from 10 MHz to 30 MHz, with the gain increasing as the frequency increases.

There are many examples of horizontal, multiband antennas (G5RV, for example) fed with a matching device such as a transmatch or antenna tuner. Most of these designs require balanced open wire feeders for proper operation. Open wire feedlines have to be supported or carefully placed to avoid proximity to conductive objects, and they may perform poorly in rainy or icy conditions.

In the March 1987 *QST* (Hints and Kinks) "A Simple, Multiband Vertical Antenna," by James G. Coote WB6AAM, the author gave a few examples of vertical antennas, successful on several bands, that used open wire and an antenna tuner. In "This Antenna Is Too Good To Be True," by J.W. Spencer W4HDX in the February 1984 issue of *73*, the author described a multiband horizontal antenna which used paralleled coax as tuned feeders. This type of feedline is immune to effects from nearby conductors and can go right into the shack without special precautions. How would this type of feed work with a vertical?

> **"The paralleled coax feed is the unique part of this antenna."**



Connections should be soldered and protected from the weather with tape or silastic compound.

It works great!

The antenna I came up with requires radials and should be elevated above ground (height not critical). The length of the vertical element and the radials should be the same. The radials should be insulated from actual ground or other conductors. The configuration is a groundplane vertical at the quarter-wave frequency. The exact length of the elements is not critical. 16.5 feet gives excellent 20 through 10 meter operation, whereas 21.5 feet gives good results down to 30 meters. Often the radials of groundplane antennas are allowed to droop to raise the feedpoint impedance. Since this antenna uses a tuner, you don't need to do this. However, if you do allow the radials to droop, it should not cause a problem.

Selecting the Tubing

Tubing with 0.047″ to 0.055″ wall thickness is available in six and eight foot lengths at many hardware stores. Tubing with outside diameters differing by ⅛″ telescope together nicely if the larger diameter tube is split with a hacksaw for two or three inches and the smaller tube is telescoped into the larger for four or five inches with the joint secured by a stainless steel hose clamp.

It is a good idea to use some anti-oxidation compound on the tubing. This type of tubing currently sells for $5–$10, depending on the diameter and length. A little scrounging will help in the cost department. I found some ⅝″ diameter tubing almost seven feet long, sold as poles to hold up sagging clotheslines, for less than $2 each.

The aluminum poles used to hold up shower curtains, 1″ in diameter and 6 feet long, sell for about $3.50 (not the anodized decorative ones, please!). Tubing (usually 12-foot lengths) is also available from wholesale supply houses. The problem is finding a supply house which will sell in small quantities. Your employer may allow you to make purchases through his purchasing department. Discarded CB base antennas and wind-damaged ham antennas are also good sources of tubing. You may also find aluminum tubing at scrap metal dealers or recycling centers.

Three six-foot lengths of tubing with overlap will do for a 16.5 foot antenna. A 21.5 foot antenna will require one eight-foot length and two six-foot lengths. The diameter of the lowest section should be at least ¾", with each subsequent section ⅛" smaller in diameter.

Constructing the Radials

The radials are made of wire (of course, they could also be made of aluminum tubing). The exact type is not particularly important. I used plastic insulated 20 AWG stranded copper wire because I happen to have a 1000-foot roll of it.

The radials should be connected at the feedpoint, and since they're hot with RF, they should have insulators at the ends farthest from the feedpoint. The radials should be equally spaced, if possible. Four radials are plenty, and you may be able to get away with using only two or three. Just be sure they are all the same length as the vertical element. This is a balanced antenna, so you don't need radials of different lengths for each band.

There are many ways of supporting the vertical element. I chose to use screw-in fence insulators (bought at the hardware store) mounted about a foot apart on a vertical 2 x 4 attached to my patio cover. The tubing is secured to the insulators with galvanized guy wire.

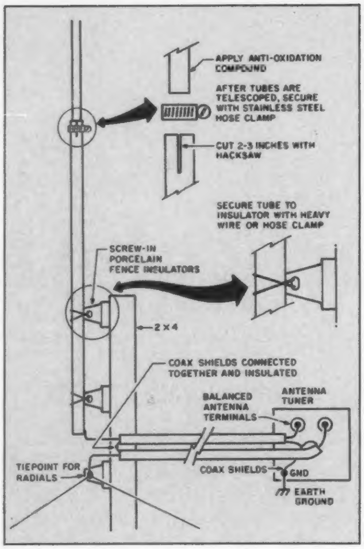
The base of the antenna is 8 feet above ground (quarter-wave at 10 meters). The radials should be at least high enough not to garrote passersby.

Choose the Right Coax

The paralleled coax feed is the unique part of this antenna. The type of coax is important; it should be solid, dielectric coax. DO NOT USE FOAM DIELECTRIC COAX. The voltage rating is not high enough, and it may break down under high SWR conditions. RG-58, RG-59, and RG-8 or their equivalents are all suitable if they can withstand the power level you're using. The feedline is constructed by paralleling two identical lengths of coax. The shields are connected together at each end and grounded at the transmatch, but left unconnected and insulated at the antenna end.

This makes a feedline of either 100 or 150 ohms impedance (depending on the type of coax). One inner conductor is connected to the vertical element and the other is connected to the radials. Most open wire feedline (also called ladderline) is usually 450 or 600 ohms. The impedance difference doesn't cause any problems. One major difference is that open wire feedline is lossless and therefore the SWR on it can be extremely high without any degradation of radiation effectiveness. Paralleled coax will have some loss and should be as short as possible. Loss introduced by a run of thirty feet or so should not be excessive—probably less than that of 3 or 4 traps.

Of course, you can use open wire lead if you insist!


APPLY ANTI-OXIDATION COMPOUND
AFTER TUBES ARE TELESCOPED, SECURE WITH STAINLESS STEEL HOSE CLAMP
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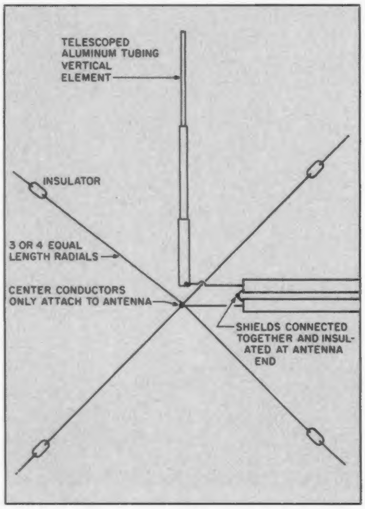
SECURE TUBE TO INSULATOR WITH HEAVY WIRE OR HOSE CLAMP
SCREW-IN PORCELAIN FENCE INSULATORS
2 x 4
COAX SHIELDS CONNECTED TOGETHER AND INSULATED
BALANCED ANTENNA TERMINALS
ANTENNA TUNER
TIEPOINT FOR RADIALS
COAX SHIELDS
GND
EARTH GROUND

Figure 1. Construction details of the multiband HF vertical. Note placement of the antenna tuner.

Operation with the Antenna Tuner

An antenna tuner (transmatch) MUST be used with this antenna. If you can find an E.F. Johnson Viking Matchbox, either the 275 watt or the 1 kilowatt unit, buy it! Works great with this antenna. These units are conservatively rated and they don't use or require a ferrite balun. Don't be concerned that they do not have bandswitch settings for the WARC bands.

> ***". . . for a cash outlay (with a bit of scrounging) of about $25 for a multiband antenna, this one can't be beat!"***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INSULATOR
3 OR 4 EQUAL LENGTH RADIALS
CENTER CONDUCTORS ONLY ATTACH TO ANTENNA
SHIELDS CONNECTED TOGETHER AND INSULATED AT ANTENNA END

Figure 2. You need only four radials to create a good grounding system.

Try tuning on the nearest band settings, both higher and lower than the desired band, and select the settings which give the best match.

Of course, other antenna tuners will also work. Simply select the terminals and settings for balanced feedline. I also recommend the new cross needle SWR meters, as they make tune-up quick and painless.

Having a no-tune transceiver, a multiband antenna, and a matching device, may seem a step backwards. The tuning is fairly broad, so you can make reasonable QSYs without retuning. The benefits are worth the trouble. Solid state rigs will not put out maximum power into a mismatch. The tuner attenuates harmonic radiation and should lessen TVI problems.

You will also note a great improvement in received signal level when the antenna is matched. Too, the tuner is inside the shack so there won't be any trips into the cold or dark to adjust for low SWR.

As Good as the Expensive, Manufactured Verticals

If I had a choice, I would prefer stacked monoband yagis at 125 feet for each band, but for a cash outlay (with a bit of scrounging) of about $25 for a multiband antenna, this one can't be beat! It's easy to tune to a very low SWR on all bands—30, 20, 17, 15, 12, and 10 meters.

You can drape the feedline here and there without unwanted effects, and bring it into the shack through a window.

It is omnidirectional, which can be either good or bad, depending on circumstances. It is my opinion that it works about as well as the most expensive manufactured vertical multiband antenna, and gives the satisfaction of doing-it-yourself and saving money at the same time.

A slim vertical rod has a minimum visual impact. It stands wind very well and rain or ice makes little difference in its performance. Give it a try!

Allen C. Ward KA5N, 9703 Ochiltree Drive, Austin TX 78753. A ham since 1954, KA5N has worked in electronics as repairman, technician, engineer, and instructor.

Parts List

Quantity	Item	Price
18–24 feet	aluminum tubing (depending on scrounging ability and tubing diameter)	$0–$25
3	fence insulators	$4.50
70–100 feet	coax	$15–$35
100 feet	wire (radials)	$0–$10
3	hose clamps	$3
1	anti-oxidation compound	$1.50
	Total Cost	$0–$80

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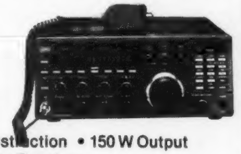

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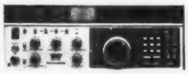

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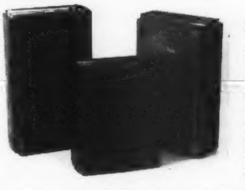

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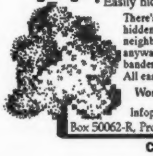

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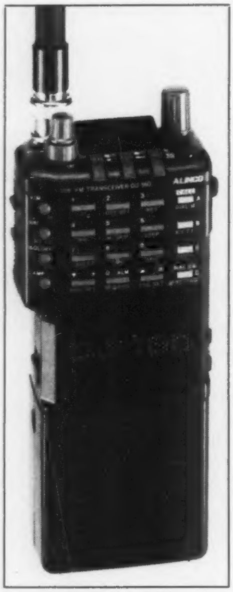
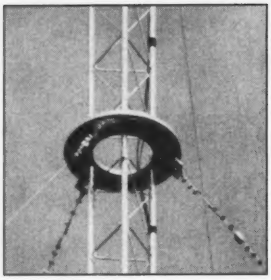
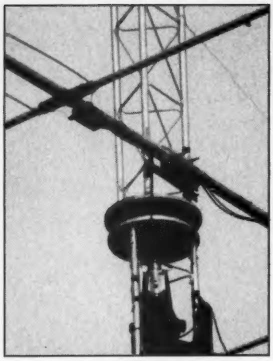


Alinco Electronics is now offering the DJ-160T (VHF) and DJ-460T (UHF) hand-held transceivers. Standard features include simple operation, easy-to-read LCD, three methods of frequency selection, 5W output when operated on 12V DC, and a unique DTMF decode/display feature. There are three scan modes, two selectable scan types, and 20 memory channels plus one call channel. The DSQ (DTMF squelch) function provides three types of paging, compatible with other manufacturers' units. These Alinco handhelds also offer many other useful features.

The suggested retail price is $400. For more information contact *Alinco Electronics, Inc., 20705 S. Western Ave., Suite 104, Torrance CA 90501. Tel. (213) 618–8616, FAX: (213) 618–8758.* Or circle Reader Service No. 201.





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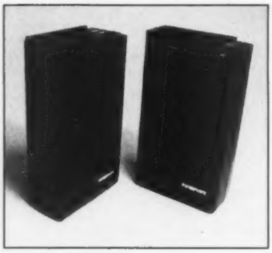

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ASHTON ITC

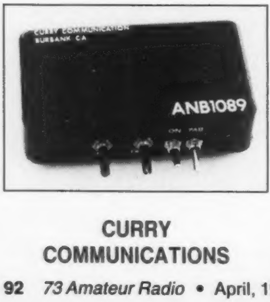
Aries-2™, is a new multi-tasking amateur radio program from Ashton ITC. Like the Aries-1™, it ties together multimode terminal units, computer-capable transceivers, and a real-time logging function. Besides reading data (frequency and mode) from transceivers, Aries-2 adds computer control of these units and supports most rigs manufactured by ICOM, Kenwood, Ten-Tec and Yaesu. This control includes the unique ability to do a timed Log Scan while optionally recording scanned TU input.

Both programs control AEA PK-232 and Kantronics KAM terminal units with simple key presses or mouse clicks. Aries-2 will allow any other smart (command driven, RS-232 capable) terminal unit to be used along with transceiver control.

The electronic logbook in both programs features fast data search capability along with automatic entry of the date and time. With Aries-2, the size of the log files is limited only by available disk space. Both products support a contest mode that offers instant dupe checking; Aries-2 lets the user sort these logs by date, prefix or country.

Both programs include sample message files, a demo-log and printed User's Guide. They are available on 5¼ or 3½ inch disks and run on IBM PC/XT/AT/PS-2s or compatibles with at least 256K memory. For Aries-2, the manufacturer suggests a minimum of 640K memory and a hard disk drive.

Aries-2 is priced at $90; Aries-1 is $65. Shipping and handling charges are extra. For more information contact *Ashton ITC, PO Box 1067, Vestal NY 13851. (607) 748–9028.* Or circle Reader Service No. 205.



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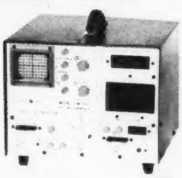

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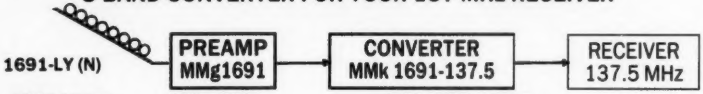

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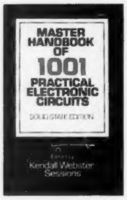

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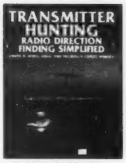
16 projects that can be assembled in a simple home workshop, a voltage detector, solid-state telephone bell, a transistor audio amplifier, and 13 others. This is an easy to understand, enjoyable guide to completing basic electronics projects—with just one evening's work. **$8.50**

05P67 • **Mastering Packet Radio: The Hands-on Guide**
by Dave Ingram K4TWJ
Packet radio is the hottest, most rapidly expanding area of amateur communications. Written for the amateur enthusiast, mastering Packet Radio will put you on the cutting edge of this digital communications revolution. **$12.50**

05S19 • **Shortwave Radio Listening with the Experts**
by Gerry L. Dexter
Do you sit for long hours in front of a radio receiver listening to faint sounds and noises? Then you're a SWLer or DXer, and you can probably use some help. **$22.50**

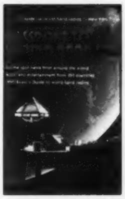


01T01 • **Transmitter Hunting: Radio Direction Finding Simplified**
by Joseph D. Moell K0OV and Thomas N. Curlee WB6UZZ
336 pages, 248 illusts. **$17.50**

05E53 • **ABC's of Electronics**
by Earl Jacob Waters
Learn the basics of electronics. A comprehensive, well illustrated look at the fundamentals of electronics and applications. **$12.50**

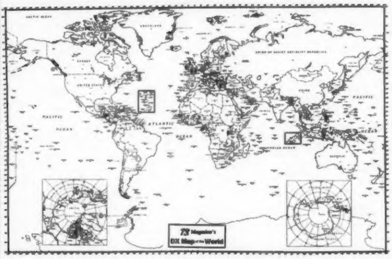
15S003 • **Communications Satellites (3rd Edtion)**
by Larry Van Horn
Includes chapters on channelization band plans, transponder identification, international satellites, and more. **$7.00**

03S04 • **The Hidden Signals on Satellite TV**
by Thomas P. Harrington and Bob Cooper Jr.
New book shows and tells how to tune in the many thousands of Telephone, Data, Telex, Teletype, Facsimile Signals on most of the TV Satellites, covers equipment, hookups, where to tune. Only book covering these secret signals on the satellites, plus all subcarriers. 234 pages. **$19.50**



06S57 • **1990 Passport to World Band Radio**
by International Broadcasting Services, Ltd.
You can have the world at your fingertips. You'll get the latest station and time grids, the 1990 Buyer's Guide and more. 384 pages. **$14.50**

THE WORLD $4.00



How can the World's Best DX Map cost only $4.00? Obviously, a serious blunder which you should take advantage of before we discover it. This is the only world map in black and white so you can color in the countries as you work them! Further, it has almost all of the official IARU 400 countries on it, which no other map at any price has.

For Better QSOing

These are books that our editors feel are excellent additions to everyone's reading experience. Although they are not necessarily ham radio books, they are thought provoking and timely.

18G01 • **"Surely You're Joking, Mr. Feynman!"**
by Richard P. Feynman
Richard Feynman, who won the Nobel Prize in physics, was one of the world's greatest theoretical physicists and thrived on outrageous adventure. He traded ideas with Einstein and Bohr, discussed gambling odds with Nick the Greek, and accompanied a ballet on the bongo drums. This is Feynman's astonishing life story—a combustible mixture of high intelligence, unlimited curiosity, eternal skepticism, and raging chutzpah. **$8.95**

19M02 • **Chaos, Making a New Science** *by James Gleick*
Chaos records the birth of a new science. This new science offers a way of seeing order and pattern where formerly only the random, the erratic, the impredictable—in short, the chaotic—had been observed. After reading *Chaos*, you will never look at the world in quite the same way again. **$9.95**

20M090 • **Computing Across America**
by Steven K. Roberts N4NRVE
Steve Roberts has written articles for *73 Magazine* about the technical aspects of his US tour on his recumbent bicycle. This book covers his adventures, people he met, and places he saw. If your lifestyle seems a little confining, check this book out. **$9.95**

CODE TAPES

One answer to the no-code brou-ha-ha is to make the code so simple to learn that it's a non-problem. Herewith the world's easiest code course—tens of thousands of hams have gotten their licenses this amazing new shortcut way. It's failure-proof. Most people are able to whip through the Novice test after spending less than three hours each on Genesis and The Stickler. People who have given up on other code courses find this one does the job in a jiffy. Going after your General? It's about time. Use the Back Breaker and you'll be there before you know it. A week should do it. Warning, 20wpm code almost invariably appears to cause irreparable, irreversable, permanent brain damage. Uncle Wayne accepts no responsibility whatever for anything that happens to those who are foolish enough to use the Courageous 20wpm tape.

73T05 **"Genesis"** **$5.95**
5 wpm—This is the beginning tape, taking you through the 26 letters, 10 numbers, and necessary punctuation, complete with practice every step of the way. The ease of learning gives confidence even to the faint of heart.

73T13 **"Back Breaker"** **$5.95**
13+ wpm—Code groups again, at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language code at only 13 per. You'll need this extra margin to overcome the sheer panic universal in most test situations. You've come this far, so don't get code shy now!

73T06 **"The Stickler"** **$5.95**
6+ wpm—This is the practice tape for those who survived the 5 wpm tape, and it's also the tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are sent at 13 wpm and spaced at 5 wpm. Code groups are entirely random characters sent in groups of five—definitely not memorizable!

73T20 **"Courageous"** **$5.95**
20+ wpm—Congratulations! Okay, the challenge of code is what's gotten you this far, so don't quit now. Go for the extra class license. We send the code faster than 20 per. It's like wearing lead weights on your feet when you run: You'll wonder why the examiner is sending so slowly!

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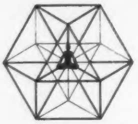

How About It?

When this column started in the December '89 issue, down at the bottom of the page we started another thing called "How About..." "How-abouts" are like the *Popular Science* or *Popular Mechanics* sections I used to love when I was a kid, titled "I'd like to see..." or some such. One "how-about" we suggested was an instantaneous radio direction finder with parasitic elements that are switched electronically, which will sample and hold a directional reading on a station that is on only a fraction of a second, for instance, a kerchunker. No response yet, such as someone coming up with one that works, a hooray or boo for the idea, or another idea that's one-up on it.

Here's another one, maybe a little closer to home, tho it's not for hams only: How about a wireless remote TV control that has a programmable delay on the MUTE switch, so you can zap your unfavorite commercials and have the sound come on again automatically when they are over? Some years ago one of the audio magazines had a clever circuit that could tell voice from music, and would let music only thru if you so desired. Any ideas? If you wanted to get really fancy, couldn't you digitally record the first few seconds of the obnoxious item and have a circuit to recognize it, with a look-up table for its length, and douse the sound for that length of time?

Another: Unisex Velcro. I've wanted this for putting together geometric models. Could be handy lots of places where you don't want to bother matching A & B types opposite each other.

Surely you readers of *73* have plenty of "how-abouts" you could come up with. So how about it? What should we offer as a reward besides seeing your idea and your name in print?

AH

For years I have been allowing that if I were stranded on a desert island with only one book to choose for company, I would select the book I call the "AH" book. AH is my abbreviation for the American Heritage Dictionary of the American Language. It also signifies the "Ahs" and "Ahas" I get from digging into the treasure-trove of Indo-European roots in the back of this book. For instance, for the word "amateur," the AH book points us to the root word "amma," where we find Latin "amare," to love, and "amicus," friend, with related words such as: amah, amative, amatory, amoretto, amour, enamour, inamorata, Mabel, paramour, aunt, amicable, amigo, amity, enemy, and inimical.

Or take the word "health." The root is "kailo-," meaning "whole, uninjured, of good omen," with related words being: hale, whole, wholesome, Eloise, hail, wassail, heal, holy, hallow, and Olga. Interesting? You should try a few words. You can get hooked on the habit of looking up roots of words. The trouble is, later versions of the American Heritage Dictionary have left out the appendix of Indo-European roots, which have been at least 95% of my fun in using this dictionary. Now its not much different from Webster's or the others. Too bad. If you can find an earlier version in a second-hand bookstore, grab it.

Enjoyment

Some of you may have followed the PBS series, "The Power of Myth," an in-depth interview of Joseph Campbell done by David Moyers. The one piece of advice I remember most vividly from Campbell was "follow your bliss."

This has been coming up when I think of ham radio. I'd say it was bliss, when I was a teenager getting my license, building a transmitter and getting it on the air, hanging around Standard Radio in Dayton, going to hamfests, talking to long-skip stations on 10 meters in the daytime, with local rag-chews around town at night, broken by occasional wild short-skip openings. I'm really curious about ham radio today, who's enjoying it, where and how? When you first got into it, where was the bliss for you? Where is it now? Where do you think it will be tomorrow? Where would you like it to be? What's your fantasy for the ideal state of enjoyability of ham radio? Have you been disappointed? Distracted? Lured away by other interests? Have QSOs lost their zest, become too much alike? Have those occasional real connections on the air become too few and far between? Is it easier just to pick up a phone and touch-tone a friend you want to talk to in complete privacy, with no QRM?

What would you like ham radio to be? I ask because right at this stage, you may be in a better position to bring it about than you realize. Radio amateurs are an asset to society, and they are a force. If we really get it together—coherent, proud, self-regulating, curious, innovative, vigorously self-respecting, our global fellowship could surface as one of the greatest forces for good on this planet.

Number 36 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
PO Box 1079
Payson AZ 85541

April should provide some highly unusual DX conditions on the HF bands. Be particularly watchful between the 3rd and the 10th, when strong magnetic field disturbances are likely.

At these times, it is also possible to experience other geophysical and atmospheric activity of an unusually severe nature. On the days surrounding the 27th, there may be some milder disturbances, but otherwise the month should provide some spectacular DX opportunities.

As always, be sure to monitor WWV on 10 MHz or 15 MHz for their propagation trends and announcements of solar activity which, as we all know, relates to earth magnetic field activity—sometimes within a few minutes and sometimes within a day or two, depending on the kind of disturbances observed. Major flares are examples of such solar upsets.

The VHF and UHF bands are also likely to exhibit unusual conditions during these times, so be sure to check them along with the HF bands.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	—	20	—	—	—	20	20	—	—	15	10/15
ARGENTINA	15	15/20	20	40	40	—	—	10	—	—	10/15	10/15
AUSTRALIA	10/15	20	20	20	20	40	20/40	20	—	—	—	10/15
CANAL ZONE	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
ENGLAND	20	40	40/80	40/80	40	—	—	15	10	15	15	20
HAWAII	10/15	15	20	20	20/40	20/40	20	20	—	—	—	10/15
INDIA	20	20	—	—	—	—	—	15	—	—	—	—
JAPAN	10	—	20	—	—	—	20	20	—	—	15	10/15
MEXICO	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
PHILIPPINES	15	—	20	20	—	—	20	10/15	10	—	—	15
PUERTO RICO	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
SOUTH AFRICA	20/40	40	20	20	—	—	—	—	10	10	15	15
U.S.S.R.	40	40/80	20	20	—	—	—	10/15	10/15	—	20	20
WEST COAST	20/40	20/40	20/40	40	40	—	—	10/15	10/15	10/15	10/15	20

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	15	20	20	20	—	20(1)	20(1)	—	—	—	10/15
ARGENTINA	15	15	20/40	20/40	20	—	—	10	—	—	10	10/15
AUSTRALIA	10/15	15	15	—	20	20/40	40	20(1)	—	—	15(1)	10
CANAL ZONE	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
ENGLAND	40(1)	40(1)/80	40(1)	—	—	—	—	—	15*	15*	20	20
HAWAII	15	15	15	20	20	20/40	40	20	—	10	10	10
INDIA	15(1)	15(1)/20	—	—	—	—	—	15(1)/20	15(1)	—	—	—
JAPAN	10/15	15	20	20	20	—	20(1)	20(1)	—	—	—	10/15
MEXICO	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
PHILIPPINES	10(1)/15	—	20(1)	20(1)	—	—	—	—	10(1)/15	10(1)/15	—	—
PUERTO RICO	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
SOUTH AFRICA	—	—	20	20	—	—	—	—	15	15	15/20	20
U.S.S.R.	—	—	—	—	—	—	—	15(1)	15(1)	15(1)	20	20

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	10/15	15	20	20	20	—	20	20	—	—	15
ARGENTINA	10/15	15	15	20	20	—	—	—	—	—	10	10
AUSTRALIA	10	10/15	15	15	20	20	20	—	20	—	—	—
CANAL ZONE	10	15	15/40	20/40	20/40(2)	—(2)	—	—	10	10	10	10
ENGLAND	20	20	—	—	—	—	—	—	15	15	15/20	20
HAWAII	10/15	10/15	15	15/20	20/40	20/40	40	—	15	10	—	—
INDIA	—	15(1)	20	—	—	—	—	—	15(1)/20	15(1)	—	—
JAPAN	10/15	10/15	15	20	20	20	—	—	20	—	—	15
MEXICO	10	15	15/40	20/40	20(2)/40	(2)	—	—	10	10	10	10
PHILIPPINES	10	10	—	—	—	—	—	20	15	15/20	—	—
PUERTO RICO	10	15	15/40	20/40	20(2)/40	(2)	—	—	10	10	10	10
SOUTH AFRICA	20	20	—	20	—	—	—	—	—	10	15	15
U.S.S.R.	20	—	—	—	20(1)	—	—	20(1)	20(1)	20	20	20
EAST COAST	20/40	20/40	20/40	40	40	—	—	10/15	10/15	10/15	10/15	20

* Try next higher band on "G" days. (1) Possible opening on this band on "G" days. (2) Try 80m. Note A: Use values of 10/15 for 12m; 20 for 17m; 40 for 30m. Note B: This chart refers to the highest band possible at the time indicated. If no luck, try next lower band.

APRIL 1990

SUN	MON	TUE	WED	THU	FRI	SAT
1 G-F	2 F	3 F-P	4 VP*	5 P	6 P	7 P
8 VP*	9 VP*	10 P-F	11 F-G	12 G	13 G	14 G
15 G	16 G	17 G-F	18 G	19 G	20 G-F	21 G-F
22 G-F	23 G-F	24 G	25 G-F	26 F-P	27 P	28 P-F
29 P-F	30 F-G					

*Very Poor

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TH-315A/TH-415A

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- 5, 2.5, or 1.5 W output, depending on the power source. Supplied battery pack (PB-2) provides 2.5 W output. Optional NiCd packs for extended operation or higher RF output available.
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Complete service manuals are available for all Kenwood transceivers and most accessories.
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